Carrier
TRANSICOLD

Bus Air Conditioning Unit

Model 68RF-50 Articulated Coach

OPERATION AND SERVICE

T-269

Carrier
TRANSICOLD

OPERATION AND SERVICE MANUAL

BUS AIR CONDITIONING UNIT

MODEL 68RF-50 ARTICULATED COACH

UNITED TECHNOLOGIES CARRIER TRANSICOLD

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SECTION 1

DESCRIPTION

1.1 INTRODUCTION

This manual contains Operating and Electrical Data, and Service Instructions for the 68RF50 Air Conditioning, Heating and Ventilation system shown in the model chart below.

The 68RF50 units are two piece systems consisting of condenser and evaporator assemblies. Two units are installed on the roof of the bus, a Front unit and a Rear unit. These units interface with the bus compressor, floor heater, and pump to provide a full air conditioning, heating and ventilation system.

The 68RF50 units are equipped with R-22 or R-134a refrigerant.

All control systems are powered by 24 vdc supplied by the bus battery and alternator or alternate source.

Operation of the 68RF50 units are controlled automatically by the temperature controller which maintains the vehicle's interior temperature at the desired setpoint.

In the cycling clutch control operation, the compressor cycles on and off to control vehicle interior temperature. In Reheat, the Reheat Coolant Valve opens and closes on thermostat command to control vehicle interior temperature while the air conditioning mode continues to operate.

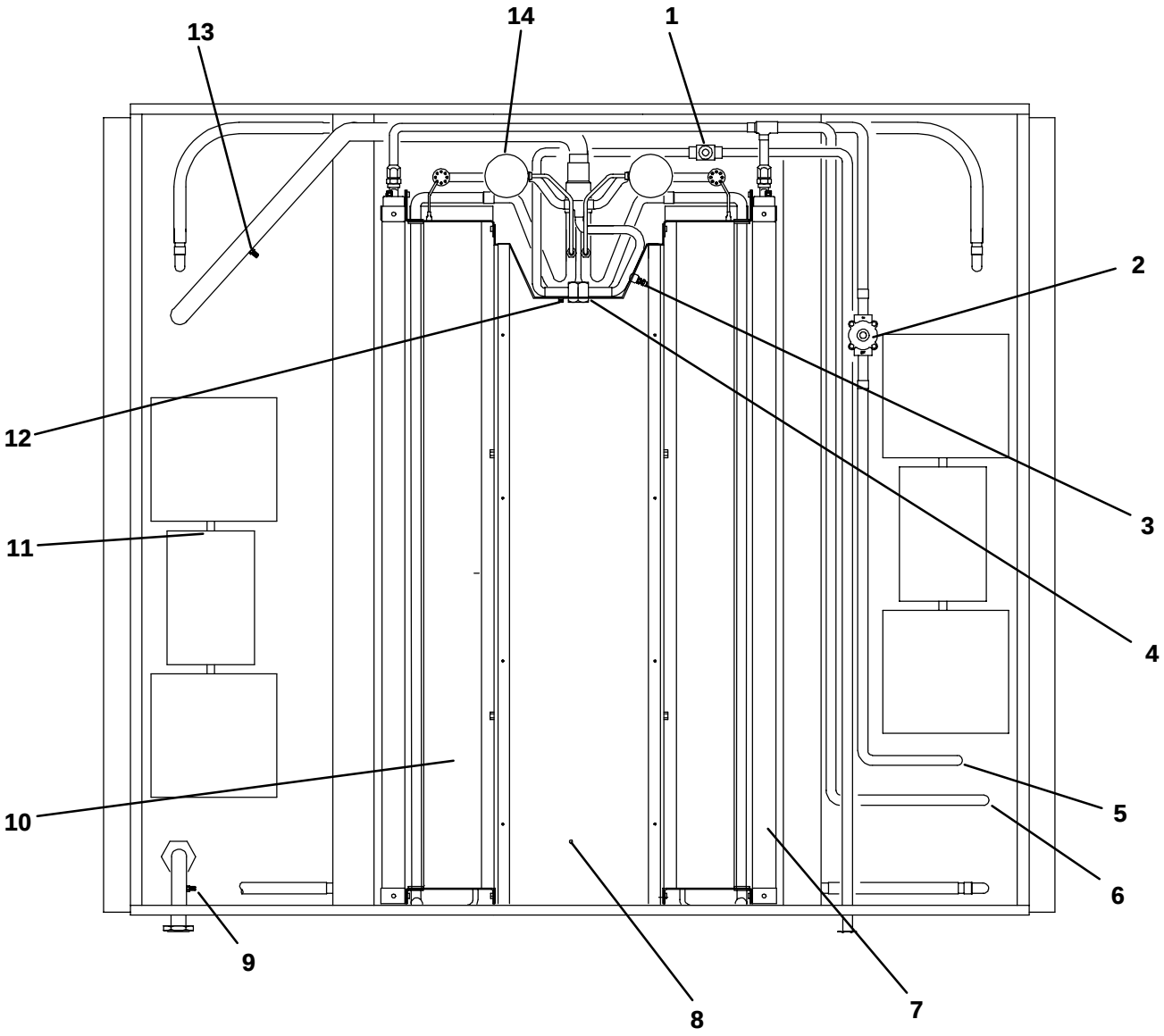
Table 1-2 below shows additional manuals available for servicing of the 68RF50 units.

Table 1-1. Model Chart

MODELS	SERIES	DESCRIPTION
68RF50	Roof Mounted	Three Condenser Fan

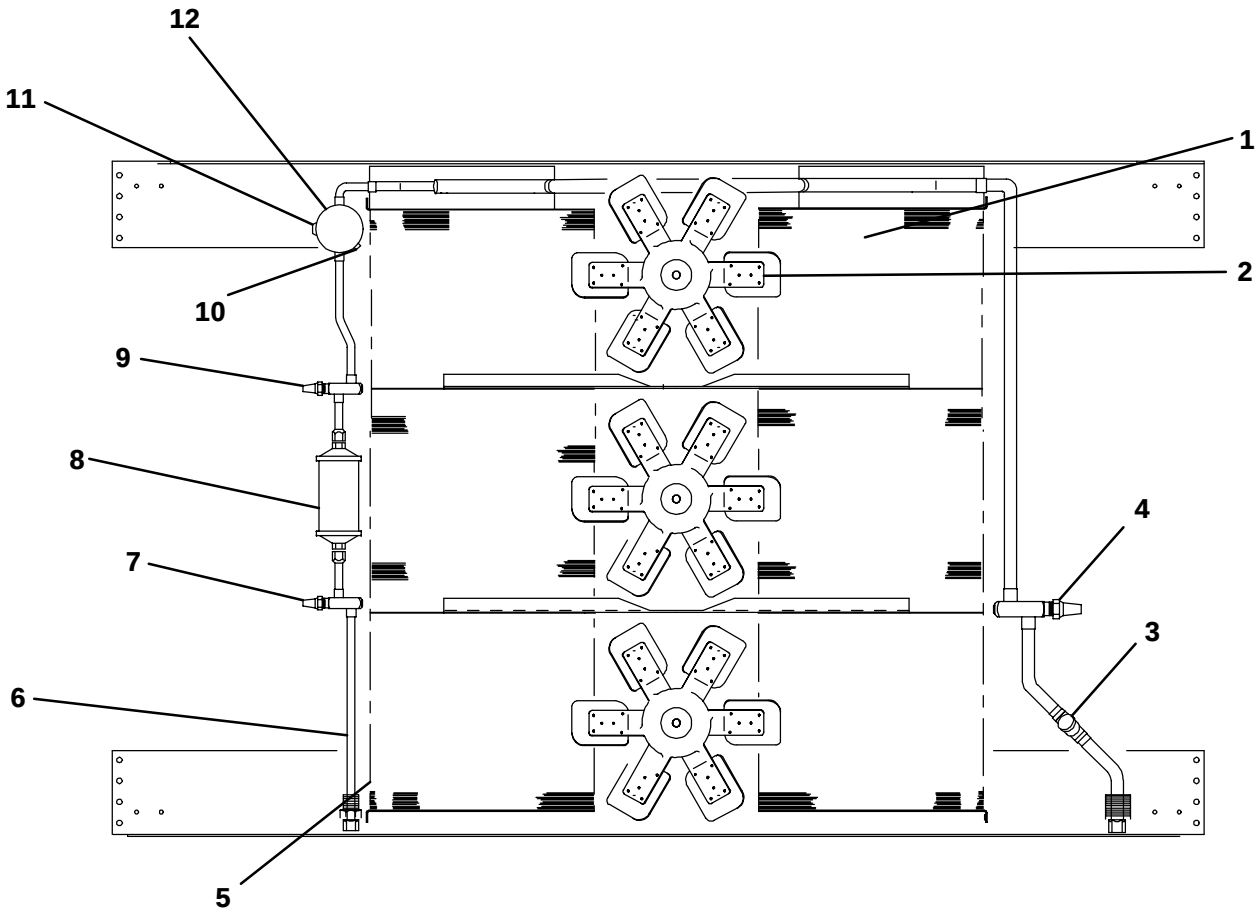
Table 1-2. Additional Support Manuals

MANUAL/FORM NO.	EQUIPMENT COVERED	TYPE OF MANUAL
62-02491-01	05K Bus Compressor	Operation and Service
62-02460	05K Bus Compressor	Parts List
T-270	DM-4 Power Pack	Operation and Service
T-270-PL	DM-4 Power Pack	Parts List



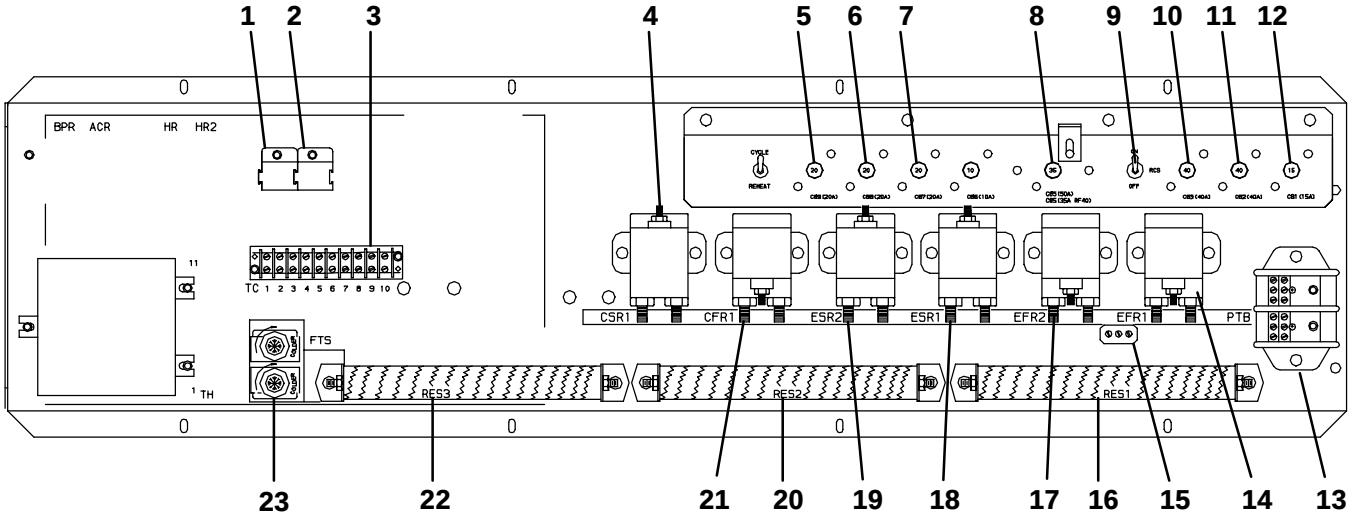
1. Liquid Line Solenoid Valve (LLS)
2. Reheat Coolant Valve (RCV)
3. High Pressure Service Port
4. In-line Sight glass
5. Hot Water Outlet
6. Hot Water Inlet
7. Heater Coil
8. Return Air Opening
9. Condenser Fan Switch (CFS)
10. Evaporator Coil
11. Evaporator Fan Blower
12. Low Pressure Service Port
13. Unloader Pressure Switch #2 (UPS2)
14. Expansion Valve (TXV)

Figure 1-1. Evaporator Assembly – Top View



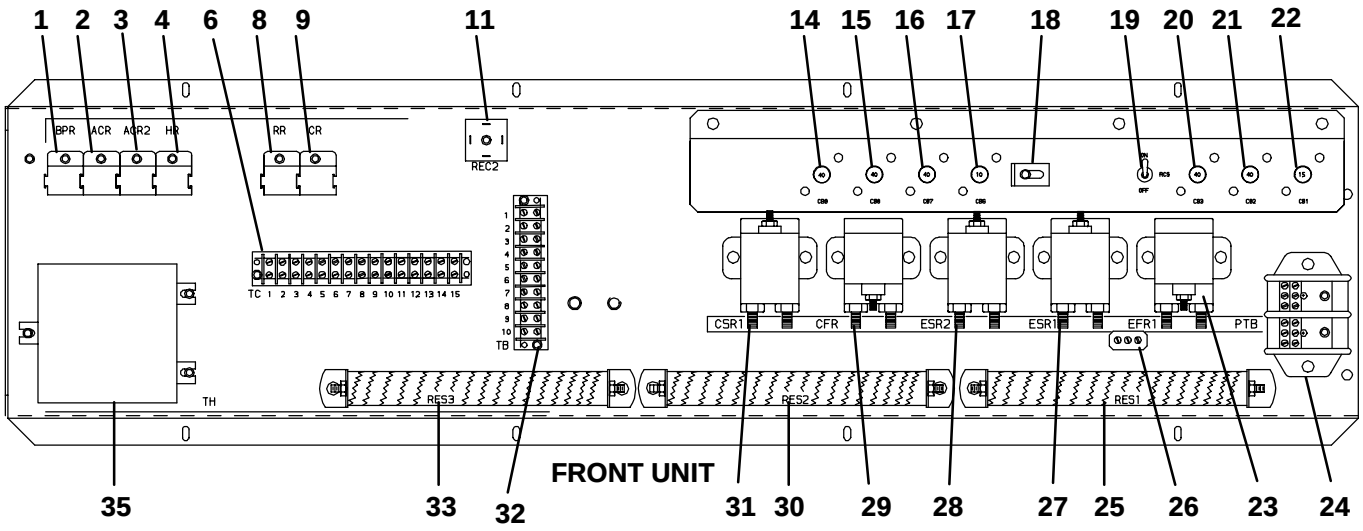
1. Condenser Coil
2. Condenser Fan Motor
3. Discharge Check Valve
4. Discharge Line Valve
5. Ambient Air Switch
6. Liquid Line
7. Filter-Drier Outlet Valve
8. Filter-Drier
9. Receiver Outlet Valve
10. Fusible Plug
11. Sight Glass
12. Receiver

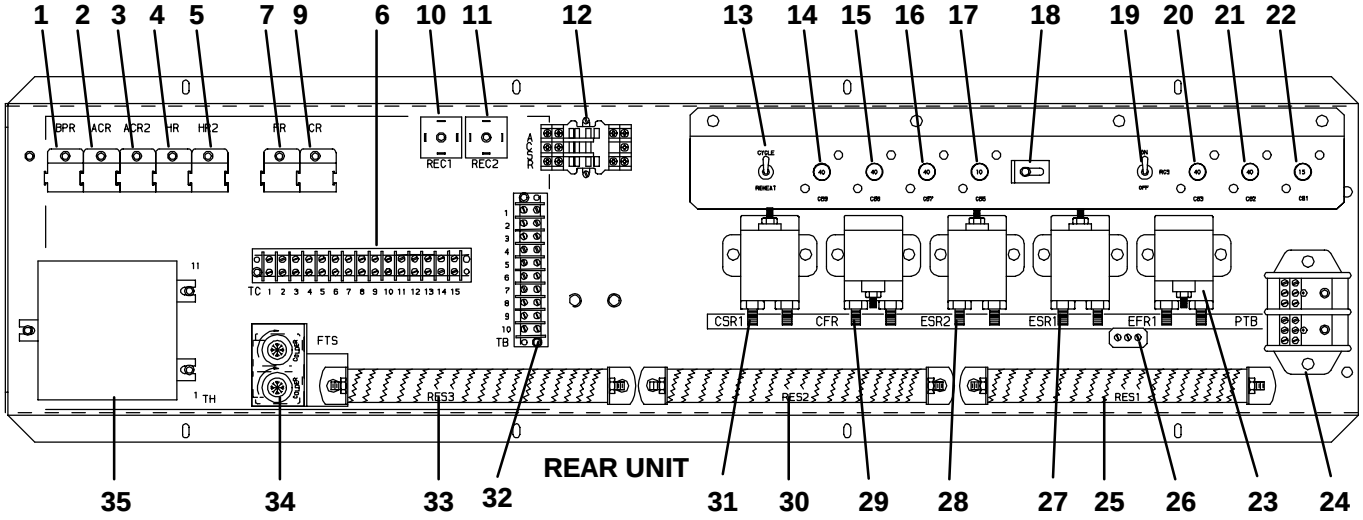
Figure 1-2. Condenser Assembly – Top View



1. Control Relay #1
2. Control Relay #2
3. Terminal Block “C” (TC)
4. Condenser Speed Relay #1 (CSR1)
5. Circuit Breaker (CB9) – 20 Amp
6. Circuit Breaker (CB8) – 20 Amp
7. Circuit Breaker (CB7) – 20 Amp
8. Circuit Breaker (CB5) – 60 Amp
9. Run Control Switch #1 (RCS1)
10. Circuit Breaker (CB3) – 40 Amp
11. Circuit Breaker (CB2) – 40 Amp
12. Circuit Breaker (CB1) – 15 Amp
13. Evaporator Fan Relay #1 (EFR1)
14. Power Terminal Block (PTB1)
15. Run Control Switch #2 (RCS2)
16. Resistor #1 – Evaporator (RES1)
17. Evaporator Fan Relay #2 (EFR2)
18. Evaporator Speed Relay #1 (ESR1)
19. Evaporator Speed Relay #2 (ESR2)
20. Resistor #2 – Evaporator (RES2)
21. Condenser Fan Relay #1 (CFR1)
22. Resistor #3 – Condenser (RES3)
23. Freeze Thermostat Switch (FTS)

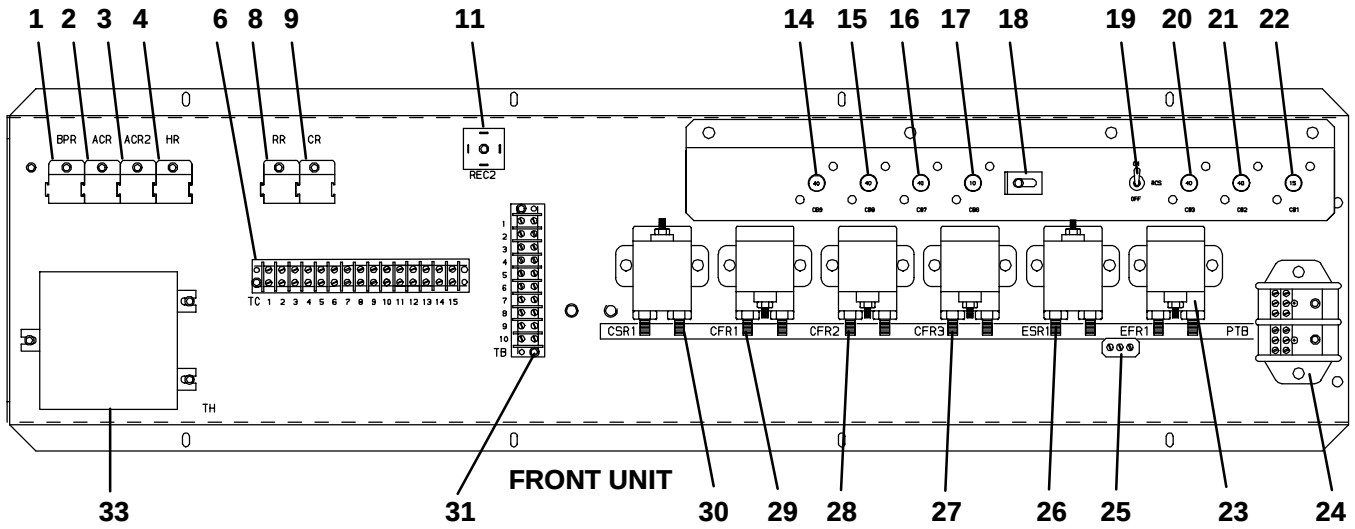
Figure 1-3. Electrical Control Panel Components for Models with Permanent Magnet Motors (ENCAVA)

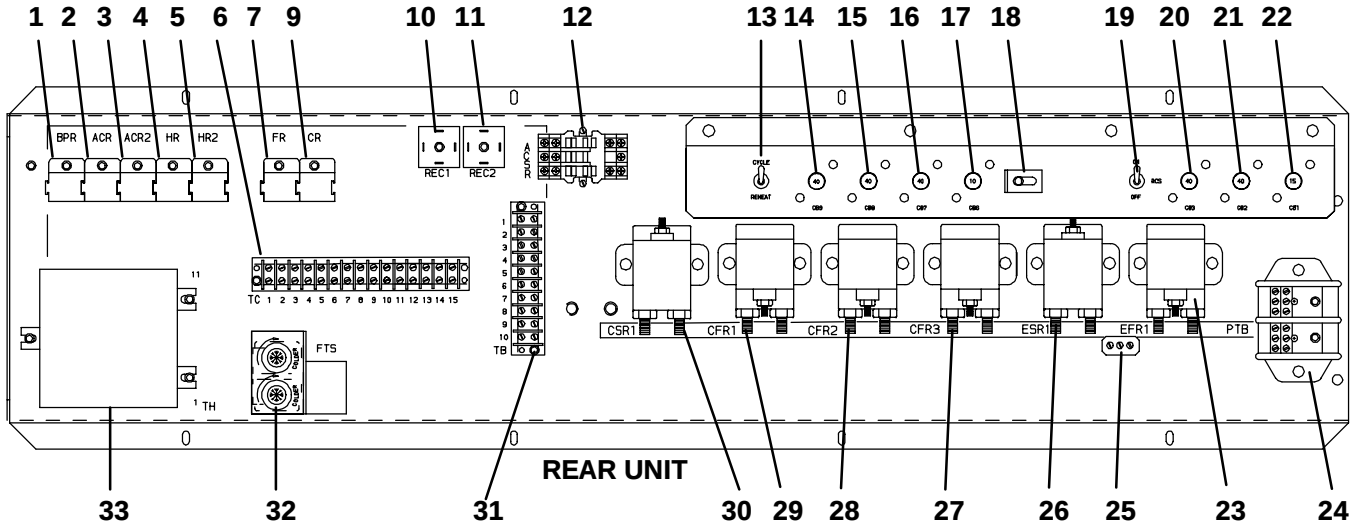




24. Boost Pump Relay (BPR)
25. A/C Relay (ACR)
26. A/C Relay #2 (ACR2)
27. Heat Relay (HR)
28. Heat Relay #2 (HR2)
29. Terminal Block “C” (TC)
30. Fault Relay (FR)
31. Run Relay (RR)
32. Control Relay (CR)
33. Rectifier #1 (REC1)
34. Rectifier #2 (REC2)
35. A/C Stop Relay (ACSR)
36. Reheat/Cycle Switch (RHCS)
37. Circuit Breaker (CB9) – 40 Amp
38. Circuit Breaker (CB8) – 40 Amp
39. Circuit Breaker (CB7) – 40 Amp
40. Circuit Breaker (CB6) – 10 Amp
41. Temperature Sensor
42. Run Control Switch #1 (RCS1)
43. Circuit Breaker (CB3) – 40 Amp
44. Circuit Breaker (CB2) – 40 Amp
45. Circuit Breaker (CB1) – 15 Amp
46. Evaporator Fan Relay #1 (EFR1)
47. Power Terminal Block (PTB)
48. Resistor #1 – Evaporator (RES1)
49. Rear Control Switch #2 (RCS2)
50. Evaporator Speed Relay #1 (ESR1)
51. Evaporator Speed Relay #2 (ESR2)
52. Condenser Fan Relay #1 (CFR1)
53. Resistor #2 – Evaporator (RES2)
54. Condenser Speed Relay #1 (CSR1)
55. Terminal Block “B” (TB)
56. Resistor #3 – Condenser (RES3)
57. Freeze Thermostat Switch (FTS)
35. Thermostat Controller (TH)

Figure 1-4. Electrical Control Panel Components for Models with Permanent Magnet Motors





1. Boost Pump Relay (BPR)
2. A/C Relay (ACR)
3. A/C Relay #2 (ACR2)
4. Heat Relay (HR)
5. Heat Relay #2 (HR2)
6. Terminal Block “C” (TC)
7. Fault Relay (FR)
8. Run Relay (RR)
9. Control Relay (CR)
10. Rectifier #1 (REC1)
11. Rectifier #2 (REC2)
12. A/C Stop Relay (ACSR)
13. Reheat/Cycle Switch (RHCS)
14. Circuit Breaker (CB9) – 40 Amp
15. Circuit Breaker (CB8) – 40 Amp
16. Circuit Breaker (CB7) – 40 Amp
17. Circuit Breaker (CB6) – 10 Amp
18. Temperature Sensor
19. Run Control Switch #1 (RCS1)
20. Circuit Breaker (CB3) – 40 Amp
21. Circuit Breaker (CB2) – 40 Amp
22. Circuit Breaker (CB1) – 15 Amp
23. Evaporator Fan Relay #1 (EFR1)
24. Power Terminal Block (PTB1)
25. Rear Control Switch #2 (RCS2)
26. Evaporator Speed Relay #1 (ESR1)
27. Condenser Fan Relay #3 (CFR3)
28. Condenser Fan Relay #2 (CFR2)
29. Condenser Fan Relay #1 (CFR1)
30. Condenser Speed Relay #1 (CSR1)
31. Terminal Block “B” (TB)
32. Freeze Thermostat Switch (FTS)
33. Thermostat Controller (TH)

Figure 1-5. Electrical Control Panel Components for Models with Field Wound Motors

1.2 REFRIGERATION SYSTEM COMPONENT SPECIFICATIONS

a. Refrigeration Charge

R-22 & R-134a: 16 lb. *(7.2 kg)*

b. Compressor

Model:	05K
No. of Cylinders:	4
Weight (Dry):	165 lbs. *(75 kg)* including clutch

Oil Charge: 6.75 pints (3.2 liters)

Oil Level:

Old Crankcase (before S/N 4994J):
Bottom to 1/4 of sight glass

New Crankcase (beginning S/N 4994J):
Between Min–Max marks on crankcase

Approved Compressor Oils –

R-22 Units

Calumet Refining Co.:	R030
Texaco :	WF68
Witco:	4GS Suniso

R-134a Units

Castrol:	Icematic SW68C
Mobil:	EAL Artic 68
ICI:	Emkarate RL68H

c. Thermostatic Expansion Valve

R-22 – TXV

Superheat Setting:	12_F to 14_F (at 32_F)
MOP Setting:	95.5 ±7 psig *(6.7 ±.49 kg/cm@)*

R-134a – TXV

Superheat Setting:	10_F *(5.6_C)* (at 32_F
MOP Setting:	53.9 ±4 psig *(3.9 ±.28 kg/cm@)*

d. Low Pressure Switch (LPS)

R-22 & R-134a Units

Opens at:	13 ±3 psig *(.91 ±.2 kg/cm@)*
Closes at:	29 ±3 psig *(2.0 ±.2 kg/cm@)*

e. High Pressure Switch (HPS)

R-22 Units

Opens at:	425 ±10 psig *(30 ±.7 kg/cm@)*
Closes at:	300 ±10 psig *(21 ±.7 kg/cm@)*

R-134a Units

Opens at:	300 ±10 psig *(21 ±.7 kg/cm@)*
Closes at:	200 ±10 psig *(14 ±.7 kg/cm@)*

f. Unloader Pressure Switch #2 (UPS2)

R-22 Units

Opens at:	65 ±5 psig *(4.5 ±.35 kg/cm@)*
Closes at:	50 ±3 psig *(3.5 ±.21 kg/cm@)*

R-134a Units

Opens at:	40 ±10 psig *(2.8 ±.7 kg/cm@)*
Closes at:	23 ±3 psig *(1.6 ±.21 kg/cm@)*

h. Condenser Fan Speed Switch (CFS)

R-22 Units

Opens for high speed:	360 ±10 psig *(25.3 ±.7 kg/cm@)*
Closes for low speed:	285 ±15 psig *(20 ±.7 kg/cm@)*

R-134a Units

Opens for high speed:	250 ±10 psig *(17.8 ±.7 kg/cm@)*
Closes for low speed:	190 ±15 psig *(13.4 ±1 kg/cm@)*

i. Low Ambient Switch (LATH)

Opens at:	45 ±5_F *(7.2_C)*
Closes at:	55 ±5_F *(12.8_C)*

j. Engine Coolant Switch (ECS)

Closes at: 120_F *(49_C)*

k. Reheat Coolant Valve (RCV)

Coil Voltage	24 vdc
MOPD:	35
Capacity:	10 GPM @ 3 psig ΔP

l. Freeze Protection Switch (FTS)

Cut-in at:	45_F
Cut-out at:	25 to 35_F

1.3 ELECTRICAL SPECIFICATIONS

a. Evaporator Blower Motor

Evaporator Motor	Field Wound	Permanent Magnet
Bearing Lubrication	Factory Lubricated (additional grease not required)	
Horsepower	0.25/0.5	0.5
Full Load Amps (FLA)	9.3/21	18
Operating Speed (RPM)	1500/2000	2000
Voltage	27vdc	27vdc
Dropping Resistor	–	0.6 Ohms 300 watts

b. Condenser Fan Motor

Condenser Motor	Field Wound	Permanent Magnet
Bearing Lubrication	Factory Lubricated (additional grease not required)	
Horsepower	0.25/0.5	0.5
Full Load Amps (FLA)	13/21	17.8
Operating Speed (RPM)	1200/1600	1550
Voltage	27vdc	27vdc
Dropping Resistor	–	0.25 Ohms 300 watts

1.4 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions with safety devices.

If the High Pressure Switch (HPS) or Low Pressure Switch (LPS) open due to unsafe operating conditions, the A/C operation will automatically stop. The A/C stop light will illuminate to indicate an unsafe condition. The evaporator blower motors will continue to run to circulate air throughout the bus.

During any mode of operation (A/C, Vent or Heat), the evaporator or condenser motors will stop if excessive current draw is sensed by the circuit breakers. All breakers must be manually reset by depressing the breaker button when opened.

When the High Pressure Switch (HPS) or Low Pressure Switch (LPS) open and unit operation stops, place the A/C Switch (ACS) to the OFF position and back to the ON position to reset the A/C Stop Relay (ACSR) and de-energize the stop light.

Table 1-3. Safety Devices

Unsafe Condition	Safety Device	Device Setting
1. Excessive current draw by the Boost Pump Motor (BPM)	Circuit Breaker – CB1 Manual Reset	Opens at 15 amps
2. Excessive current draw by Evaporator Blower Motor #2 (EM2)	Circuit Breaker – CB2 Manual Reset	Opens at 40 amps
3. Excessive current draw by Evaporator Blower Motor #1 (EM1)	Circuit Breaker – CB3 Manual Reset	Opens at 40 amps
4. Excessive current draw by Clutch (C)	Circuit Breaker – CB6 Manual Reset	Opens at 10 amps
5. Excessive current draw by Condenser Fan Motor #1 (CM1)	Circuit Breaker – CB7 Manual Reset	Opens at 40 amps
6. Excessive current draw by Condenser Fan Motor #2 (CM2)	Circuit Breaker – CB8 Manual Reset	Opens at 40 amps
7. Excessive current draw by Condenser Fan Motor #3 (CM3)	Circuit Breaker – CB9 Manual Reset	Opens at 40 amps
8. High system pressure	High Pressure Switch (HPS) Automatic reset	**R-22:** Opens at 425 ±10 psig *(30 ±.7 kg/cm@)* **134a:** Opens at 300 ±10 psig *(21 ±.7 kg/cm@)*
9. Low system pressure	Low Pressure Switch (LPS) Automatic Reset	Opens at 13 ±3 psig *(.91 ±.21 kg/cm@)*

1.5 SYSTEM OPERATING CONTROLS AND COMPONENTS

a. Temperature Controller (Thermostat) (TH)

The Temperature Controller (TH) is a thermostat that senses and controls the vehicle interior air temperature.

The desired interior temperature setpoint of the Controller is fixed with resistors and is located on the control panel (see Figure 1-4 or Figure 1-5). The Controller's temperature sensor monitors bus interior temperature at the return air section of the unit and controls the operation function of the system to maintain setpoint.

b. Manual Switches

A/C Switch (ACS)

The A/C Switch (ACS) activates the Air Conditioning, Heating or Vent modes of operation. This switch is located on the driver's control panel. ACS is placed in COOL position to energize the A/C Relays (ACR), in HEAT position to energize Heat Relay (HR), or in the Vent position for high speed evaporator fan circulation. In A/C and Heat positions, 24 volts are also fed to terminal block C (TC). When in Vent position, 24 volts are fed directly to Run Control Switch (RCS) to power Evaporator Fan Relay #1 (EFR1).

Reheat/Cycle Switch (RHCS)

The Reheat/Cycle Switch (RHCS) allows operator to select the optional Reheat or Cycling clutch control action.

Defrost Switch (DFS) (Customer supplied)

The Defrost Switch (DFS) will manually energize the Boost Pump Relay (BPR) to activate the Boost Pump Motor (BPM) and Reheat Coolant Valve (RCV) coil. The valve will open to allow engine coolant flow to the driver's defroster/heater coil. When closed, DFS will override the Temperature Controller.

Rear Control Switches (RCS1 & RCS2)

The Rear Control Switches (RCS1 & RCS2) are located on the electrical control panel in the return air opening of the unit. When placed in the OFF position, RCS1 and/or RCS2 prevent the unit from starting while servicing.

c. Thermal Switches

Engine Coolant Switch (ECS) (Customer supplied)

The Engine Coolant Switch (ECS) located on the engine block of the vehicle senses the vehicle engine coolant temperature. ECS closes at 120_F (49_C) on temperature rise. The switch prevents the circulation of cooler air throughout the vehicle during the initial start-up of the vehicle and unit.

Low Ambient Thermostat (LATH)

The Low Ambient Thermostat (LATH) monitors the vehicle's outside temperature. The switch opens at 45 ± 5_F (7.2_C) and closes at 55 ± 5_F (12.8_C). When the outside temperature is below the open setting of the switch, the switch opens to stop the compressor clutch and condenser fans.

Auxiliary Heater Thermostat (AHT) (Customer supplied)

The Auxiliary Heater Thermostat (AHT) opens to prevent the Auxiliary Heater Relay (AHR) from energizing during high ambient temperatures.

d. Pressure Switches

Condenser Fan Speed Switch (CFS)

The Condenser Fan Speed Switch (CFS) is located on the discharge line to control condenser fan speed. If the condenser coil pressure rises to CFS cut-out setting, the switch will open to de-energize Condenser Speed Relays #1, #2, #3 (CSR1, CSR2 & CSR3). This will cause Condenser Fan Motors (CM1, CM2 & CM3) to run at high speed. When pressure drops to the CFS cut-in setting, the switch will close, energizing CSR1, CSR2 & CSR3 to run the Condenser Fan Motors at low speed. Refer to section 1.2 for switch settings.

Unloader Pressure Switch #2 (UPS2) (Optional)

Unloader Pressure Switch #2 (UPS2) controls unloader operation during A/C.

UPS2 closes on pressure drop to energize Unloader Valve #1 (UV1). Energizing UV1 will place the compressor in 2-cylinder operation. As pressure rises, the switch will re-open. Refer to section 1.2 for switch settings.

e. Relays (See Figure 1-4 or Figure 1-5)

Fault Relay (FR)

The Fault Relay (FR) is located on the electrical control panel in the return air opening of the unit (see Figure 1-2). FR is energized during initial start -up of the unit. If the High or Low Pressure Switch (HPS or LPS) open due to unsafe operating conditions, FR de-energizes and closes an internal set of FR contacts to energize A/C Stop Relay (ACSR).

A/C Stop Relay (ACSR)

The A/C Stop Relay (ACSR) is located on the electrical control panel in the return air opening of the unit (see Figure 1-2). ACSR is a time delay relay that energizes the stop light when activated by Fault Relay (FR).

To restart the unit and turn the stop light off, the A/C Switch (ACS) must be toggled off and on.

Control Relay (CR)

The Control Relay (CR) is located on the electrical control panel. When CR is energized, a set of internal contacts will close to activate Compressor Clutch (CL) to start the refrigerant cycle.

Air Conditioning Relays (ACR1 & ACR2)

The Air Conditioning Relays (ACR1 & 2) are located on the electrical control panel. ACR1 & 2 are energized when A/C Switch (ACS) is placed in A/C position. When ACR1 & 2 are energized, a set of internal contacts will close to allow Clutch (CL) and Condenser Fan Relays (CFR) to energize. ACR1 & 2 prevent CL and condenser fans from activating when HEAT operation is selected.

Heat Relays (HR & HR2)

Heat Relays (HR & HR2) are located on the electrical control panel. These relays will only energize when the A/C Switch (ACS) is in HEAT position. When energized, a set of internal contacts close to bypass the Reheat/Cycle Switch (RHCS) and allow power directly to Boost Pump Relay (BPR) during heating.

Evaporator Fan Relay #1 (EFR1)

Evaporator Fan Relay #1 (EFR1) is located on the electrical control panel. When the A/C Switch (ACS) is placed in either COOL or HEAT position, EFR1 is energized. When energized, a set of internal EFR1 contacts are closed to start the Evaporator Blower Motors (EM1 & EM2).

Evaporator Speed Relay (ESR1)

The Evaporator Speed Relay (ESR1) is located on the electrical control panel. This relay will only energize when A/C Switch (ACS) is in the HEAT position. When energized, the internal contacts will start low speed evaporator fan operation.

Condenser Fan Relays #1, #2 & #3 (CFR1, CFR2 & CFR3)

The Condenser Fan Relays #1, #2 & #3 (CFR1, 2 & 3) are located on the electrical control panel. When A/C Switch (ACS) is placed in COOL position and the thermostat requires cooling (switch THSW1 is in the COOL position) CFR1, 2 & 3 are energized. When energized, a set of internal CFR1, 2 & 3 contacts are closed to start the Condenser Fan Motors (CM1, 2 & 3). The Low Ambient Thermostat (LATH) must be closed to energize CFR1, 2 & 3.

Condenser Speed Relay (CSR1)

Condenser Speed Relay (CSR1) is located on the electrical control panel. CSR1 is energized at the same moment Condenser Fan Relays are. When energized, CSR1 will open a set of internal CSR1 contacts for low speed condenser fan operation. If the condenser coil pressure reaches Condenser Fan Speed Switch (CFS) cut-out setting, CFS will open to de-energize CSR1 (refer to section 1.2 for switch settings). This will cause Condenser Fan Motors (CM1, 2 & 3) to run at high speed.

Boost Pump Relay (BPR)

The Boost Pump Relay (BPR) is located on the electrical control panel. This relay is energized during heating. When BPR is energized, a set of internal contacts close to activate the Boost Pump Motor (BPM).

1.6 REFRIGERATION FLOW CYCLE (See Figure 1-6)

The refrigeration system contains R-22 or R134a refrigerant. The refrigeration cycle is the same for air conditioning and heating (during reheat mode). The refrigerant cycle is off during vent only mode; only the evaporator blowers operate to circulate air throughout the bus.

The refrigeration cycle begins when the compressor Clutch (CL) is engaged. The compressor raises the pressure and the temperature of the refrigerant and forces it into the condenser tubes. The condenser fans circulate surrounding air (which is a lower temperature than the refrigerant) over the outside of the condenser tubes. Heat transfers from the refrigerant (inside the tubes) to the condenser air (flowing over the tubes). The condenser tubes have fins designed to improve the transfer of heat from the refrigerant gas to the air. This removal of heat causes the refrigerant to liquefy. The liquid refrigerant leaves the condenser and flows to the receiver.

The receiver serves as a liquid refrigerant reservoir so a constant supply of liquid is available to the evaporator as needed and as a storage space when pumping down the system. The receiver is equipped with two sight glasses to observe the correct charge level.

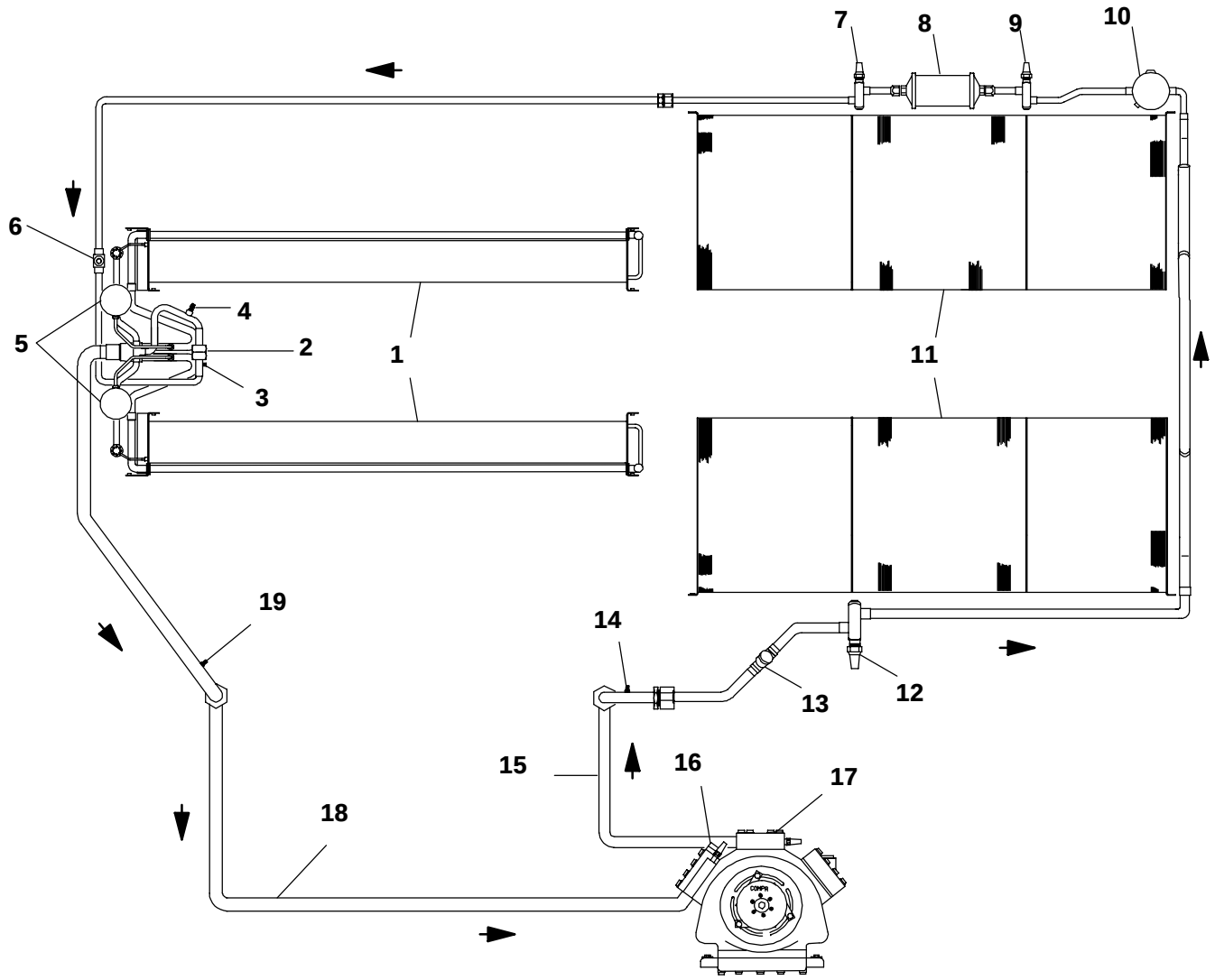
The refrigerant leaves the receiver and flows through the filter-drier inlet service valve to the filter-drier where an absorbent keeps the refrigerant clean and dry. The flow continues through a filter-drier outlet service valve.

Next the liquid refrigerant flows through a Liquid Line Solenoid Valve (LLS). LLS is normally closed. When the Compressor Clutch (CL) is engaged 24 volts are sent to the coil of LLS, opening the valve and allowing liquid to flow.

The liquid then flows through externally equalized thermostatic expansion valves which reduce the pressure and temperature of the liquid and meter the flow of liquid refrigerant to the evaporator to obtain maximum use of the evaporator heat transfer surface.

The low pressure, low temperature liquid that flows into the evaporator tubes is colder than the air that is circulated over the evaporator tubes by the evaporator blowers. Heat transfer is established from the evaporator air (flowing over the tubes) to the refrigerant (inside the tubes). The evaporator tubes have aluminum fins to increase heat transfer from the air to the refrigerant; therefore the cooler air is circulated to the interior of bus.

The transfer of heat from the air to the low temperature liquid refrigerant in the evaporator causes the liquid to vaporize. This low temperature, low pressure vapor passes through the suction line where the low pressure refrigerant vapor is now drawn into the compressor where the cycle repeats.



1. Evaporator Coils
2. Inline Sight Glass
3. Low Pressure Service Port
4. High Pressure Service Port
5. Expansion Valves
6. Liquid Line Solenoid Valve
7. Filter-Drier Outlet Valve
8. Filter-Drier
9. Receiver Outlet Valve
10. Receiver
11. Condenser Coils
12. Discharge Line Valve
13. Discharge Check Valve
14. Unloader Pressure Port 2
15. Discharge Line
16. Discharge Service Valve
17. Suction Service Valve
18. Suction Line
19. Condenser Fan Pressure Port

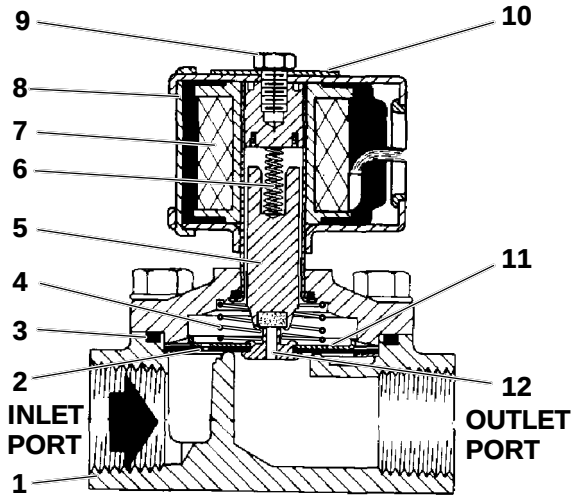
Figure 1-6. Refrigeration Cycle Diagram

1.7 REHEAT COOLANT VALVE (RCV)

The Reheat Coolant Valve (RCV) is located in the evaporator section of the unit on the roof of the bus (see Figure 1-1). RCV is an electrically operated solenoid valve controlled by thermostat command. RCV controls the coolant flow to the heater coil during Heating. RCV is normally closed and opens when the coil is energized. RCV closes when the coil is de-energized.

When the thermostat calls for Heating, the RCV coil is energized, the plunger is lifted and the pilot port is opened to relieve pressure on top of the diaphragm. Now the valve inlet pressure will act on the bottom portion of the diaphragm, lifting the diaphragm to open the main port. Once the port is open, the diaphragm is held off the seat by the pressure difference across the port. When the coil is de-energized, the plunger drops due to the kick-off spring and closes the pilot port. The pressure above the diaphragm is no longer vented to the downstream side of the valve and the diaphragm drops, closing the main port.

RCV Maximum Operating Pressure Differential (MOPD) is 35. The MOPD is the maximum pressure differential against which the solenoid will open. RCV has a ten gallon per minute minimum capacity with 3 psig pressure differential across the valve.



1. Valve Body
2. Equalizer Port
3. O-Ring
4. Closing Spring
5. Plunger
6. Kick-Off Spring
7. Coil
8. Coil Housing Assembly
9. Coil Retaining Screw
10. Nameplate
11. Diaphragm
12. Pilot Port

Figure 1-7. Reheat Coolant Valve (RCV)

1.8 LIQUID LINE SOLENOID VALVE (LLS)

The Liquid Line Solenoid Valve (LLS) is located in the evaporator section of the unit on the roof of the bus (see Figure 1-1). The electrically operated solenoid valve is energized when the Compressor Clutch (CL) is engaged. LLS controls the flow of refrigerant to the expansion valve during air conditioning mode. LLS is normally closed and opens when the coil is energized. LLS closes when the coil is de-energized.

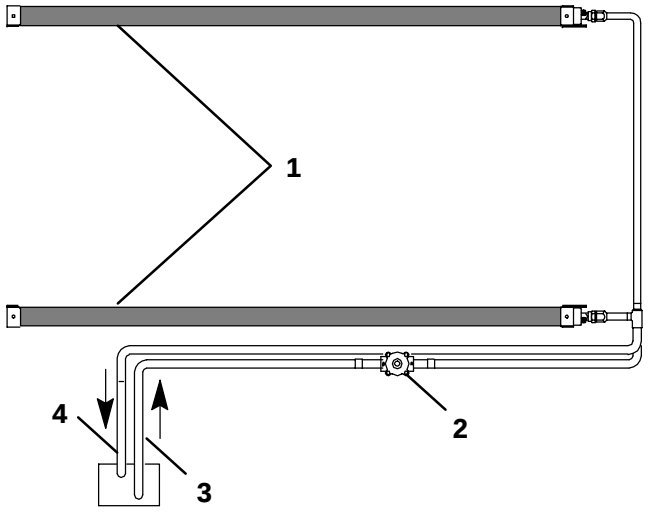
1.9 MOISTURE/LIQUID INDICATOR

The moisture/liquid indicator is located on the liquid line between the Liquid Line Solenoid (LLS) and the expansion valve. The element in the indicator is highly sensitive to moisture and will gradually change color in direct relation to an increase or decrease in the moisture content of the system. The dry-caution-wet system operating conditions are then easily determined by matching the element color with the four colors displayed on the reference label. Colors change as often as the system moisture content changes.

1.10 HEATER COOLANT FLOW CYCLE

Heating is controlled by the thermostat which controls the operation of the Reheat Coolant Valve (RCV). When the RCV solenoid is energized, the valve will open to allow engine coolant to flow through the heater coil. Refer to section 2.3.3 for control operation.

At the same time RCV is energized, the Boost Pump (customer supplied) is activated to circulate the engine coolant through the inlet tube and header hose to the heater coil. The coolant exits the coil and flows through the valve inlet hose. With RCV open, coolant flows through the valve outlet and coolant outlet tube back to the engine.



1. Heater Coil
2. Reheat Coolant Valve
3. Coolant Inlet Tube
4. Coolant Outlet Tube

Figure 1-8. Heater Coolant Flow Diagram

SECTION 2

OPERATION

2.1 STARTING AND STOPPING INSTRUCTIONS

a. Starting the Front Unit

1. Refer to Power Pack operation manual, Form T-270 before starting.
2. Once the Power Pack is started, the unit automatically switches to COOL mode.

b. Starting the Rear Unit

1. Start the vehicle engine.
2. Switch A/C Switch (ACS) to desired mode of operation (COOL, HEAT or VENT).

NOTE

The Rear Control Switches (RCS1 & RCS2) located on the control panel in the unit must be in the ON position for unit operation to start.

c. Stopping Front and Rear Units

1. Switch A/C Switch (ACS) to the OFF position.

NOTE

Be sure rear air conditioning unit is turned off before stopping the engine.

2.2 PRE-TRIP INSPECTION

After starting unit, allow system to stabilize (10 to 15 minutes) and proceed as follows:

1. Listen for abnormal noises.
2. Check compressor oil level.
3. Check refrigerant level.
4. Check moisture-liquid indicator.

2.3 UNIT OPERATION

The desired Cooling or Heating modes of operation are selected manually with the A/C Switch (ACS) located on the driver's switch panel. The selection of Cycling Clutch or Reheat cooling control for the Rear Unit is also selected manually with the Reheat/Cycle Switch (RHCS) located on the unit's control panel in the return air section of the vehicle. When an operation is selected, the Electronic Control Thermostat (TH) senses the vehicle's interior temperature and automatically controls the system to maintain the desired temperature set point.

The Rear Unit Cycling Clutch and Reheat control actions function only during cooling operation. During heat, the Reheat/Cycle Switch (RHCS) is by-passed by the closed Heat Relay (HR) contact.

Depending on the unit model, evaporator fan speed control may be manual or automatic; if automatic the fans will operate low speed in heat and high speed in cool.

The unit control circuits and components are 24 volts which are supplied by the bus battery or alternator.

2.3.1 Air Conditioning Operation – Front Power Pack Unit (See Figure 2-1.)

Before operation of the Power Pack driven rooftop unit, review the Power Pack operation manual, Form T-270 for proper starting and safety procedures.

The A/C Switch (ACS) is placed in the "*front a/c on*" position to set the Front Unit Power Pack in the COOL mode. After Power Pack engine starting, the unit's electronic thermostat (TH) automatically adjusts Power Pack engine speed (IR), compressor unloading (UV1) and Reheat Coolant Valve (RCV).

When the return air temperature drops to 2_F above setpoint, the engine idle relay (IR) located in the Power Pack electrical box) is energized for high speed engine. The compressor unloading coil (UV1) is de-energized (fully loaded 4-cylinder) as is the Reheat Coolant Valve (RCV), no coolant flow.

When the temperature drops below 2_F above setpoint, the UV1 coil is energized. The compressor will now operate in 2-cylinder operation.

When the temperature drops to setpoint, the IR relay is de-energized and the UV1 coil stays energized. The engine is now in low speed and the compressor unloaded (2-cylinder) when the temperature drops 2_F below setpoint. The REHEAT mode is engaged and the RCV is energized, allowing coolant to flow through the heater coils. At this time, the electronic thermostat (TH) measures both return air and outlet air temperatures. RCV is cycled to keep the outlet air temperature within a 4_F band.

When return air temperature rises to setpoint, TH disengages REHEAT mode and de-energizes RCV. The unit is now in low speed engine and semi-loaded (2-cylinder) compressor operation.

If the evaporator coil Freeze Protection probe senses too low a coil temperature, the unit will switch to REHEAT mode. The unit will operate in low speed engine and unloaded compressor until the probe senses proper minimum coil temperature. The unit then switches to the usual cooling mode.

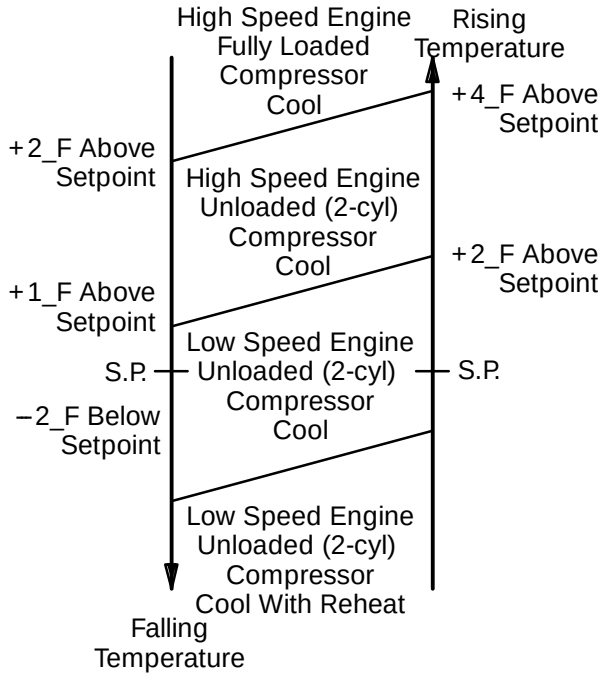


Figure 2-1. Front Unit – Temperature Controller Sequence During POWER PACK Cooling

2.3.2 Air Conditioning Operation – Rear Unit Cycling Clutch Control (See Figure 2-2)

To operate in Cycling Clutch operation, the Reheat/Cycle Switch (RHCS) is placed in the CYCLE position. In cycle control operation, the compressor cycles on and off to control vehicle interior temperature.

The A/C Switch (ACS) is placed in the COOL position to activate A/C operation. With ACS in COOL position, 24 volts are supplied to A/C Relay (ACR), which will close a set of normally open ACR contacts. Current also flows to Rear Control Switches (RCS1 & RCS2). Through these switches, current flows to Fault Relay (FR), Evaporator Fan Relay (EFR1) to start fan operation, and Temperature Controller (TH).

When the vehicle's interior temperature rises 3˚F above thermostat set point, Control Thermostat Switch, TH5 switches to COOL position to energize Control Relay (CR) through closed ACR contacts. This will start the refrigerant flow cycle. When TH6 closes, the Condenser Fan Relays (CFR) and Condenser Speed Relays (CSR) will energize to start the Condenser Fan Motors (CM) in low speed operation. The Low Ambient Switch (LATH) must be closed for the above relays to energize. Also at this time, Controller Switch TH3 will close to energize Unloader Valve #1 (UV1) to unload one bank of the compressor. The compressor will now operate in 2-cylinder operation.

When the vehicle interior temperature drops to 1˚F above setpoint, the unit will shift to VENT mode. The Controller Switches, TH3 and TH6 will open to de-energize Control Relay (CR), Condenser Fan (CFR) and Speed Relays (CSR), and Unloader Valve #1 (UV1) (see Figure 2-2 and Figure 2-6). This will stop the compressor and condenser fan operations. The evaporator fans will continue to run in high speed.

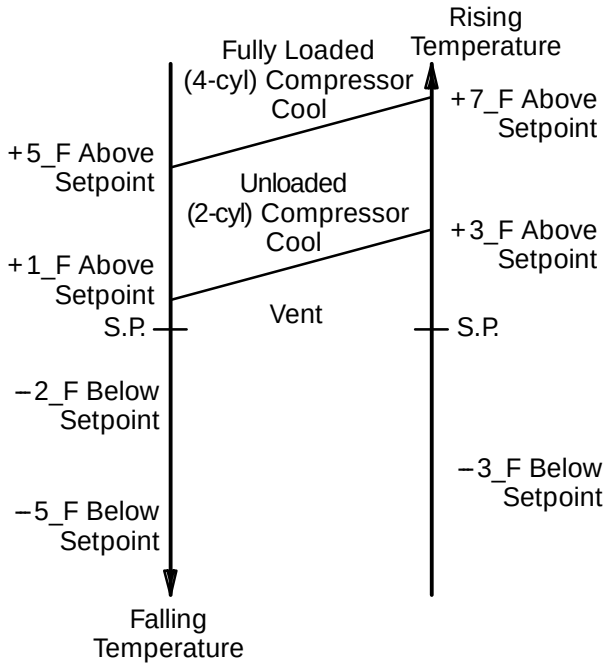


Figure 2-2. Rear Unit – Temperature Controller Sequence During CYCLING CLUTCH Cooling

2.3.3 Air Conditioning Operation – Rear Unit Reheat Control (See Figure 2-3)

To operate in Reheat, Reheat/Cycle Switch (RHCS) is placed in REHEAT position. In Reheat, the Reheat Coolant Valve (RCV) opens and closes on thermostat command to control vehicle interior temperature while air conditioning mode continues to operate.

During Reheat Air Conditioning, the Thermostat Switch THSW1 is open. Power is supplied to the A/C circuit through the closed RHCS from terminal 1 of Terminal Block C (TC). Controller Switch TH3 is closed to activate Unloader Valve #1 (UV1) for 4-cylinder compressor operation (See Figure 2-3 and Figure 2-7).

When the vehicle interior temperature drops 2˚F below setpoint, Controller Switch TH10, switches to HEAT position. The closed switch will allow current flow through the closed RHCS to energize Auxiliary Heat Relay (AHR) and Boost Pump Relay (BPR). Energizing BPR will close a normally open set of BPR contacts to activate RCV. TH10 opens and closes on thermostat command to control vehicle interior temperature. Also at this time Controller Switch, TH3 closes to energize UV1, to unload one bank of the compressor. The compressor will now operate in 2-cylinder operation.

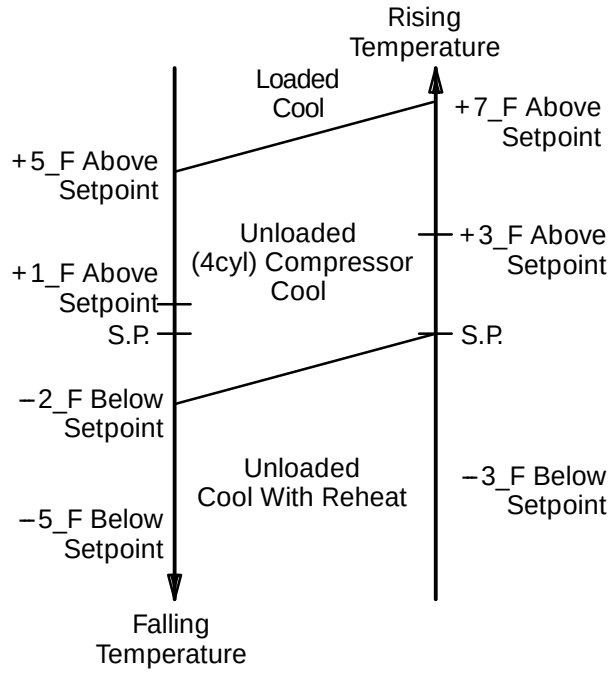


Figure 2-3. Rear Unit – Temperature Controller Sequence During REHEAT Cooling

2.3.4 Heat Operation (See Figure 2-4.)

To operate in heat, A/C Switch (ACS) is placed in the HEAT position to activate heat. Through the switch, 24 vdc power energizes Heat Relay (HR) to close a set of normally open HR contacts. This will allow the Boost Pump Relay (BPR) and Auxiliary Heat Relay (AHR) to energize on thermostat command.

When ACS is closed, power is also supplied to closed Rear Control Switches (RCS1 & 2). Through these switches, power flows to the Fault Relay (FR), Evaporator Fan Relay (EFR1) to start fan operation, and Temperature Controller (TH).

When the vehicle interior temperature drops 1˚F above setpoint, Controller Switch TH10 switches to HEAT position. Power flows through the closed Heat Relay (HR) contacts to energize Auxiliary Heat Relay (AHR) and Boost Pump Relay (BPR). Energizing BPR will close a normally open set of BPR contacts to activate Reheat Coolant Valve (RCV). RCV is opened to allow engine coolant flow through the heater coils. This valve is opened and closed on thermostat command to control vehicle interior temperature.

When the vehicle interior temperature rises to setpoint, Thermostat Switch THSW1 switches to the OFF position (see Figure 2-4 and Figure 2-10). This will de-energize RCV, AHR and BPR. The system will now be in VENT mode. During VENT mode evaporator motors will continue to circulate air throughout the vehicle.

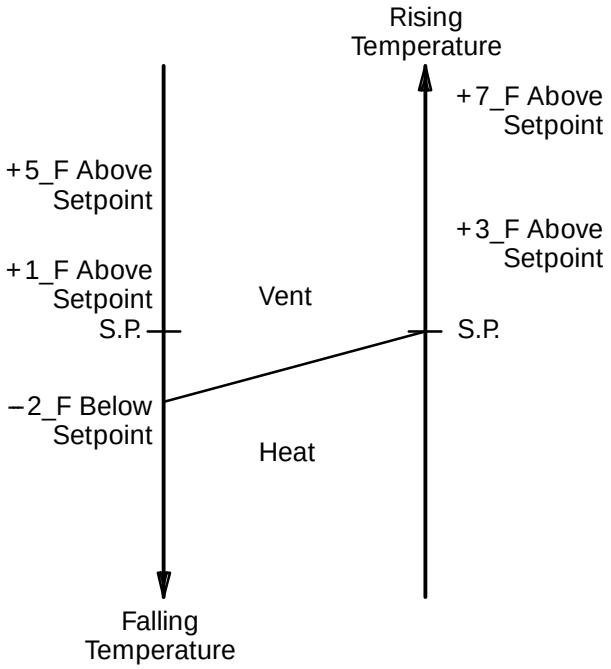


Figure 2-4. Front and Rear Units Temperature Controller Sequence During HEAT

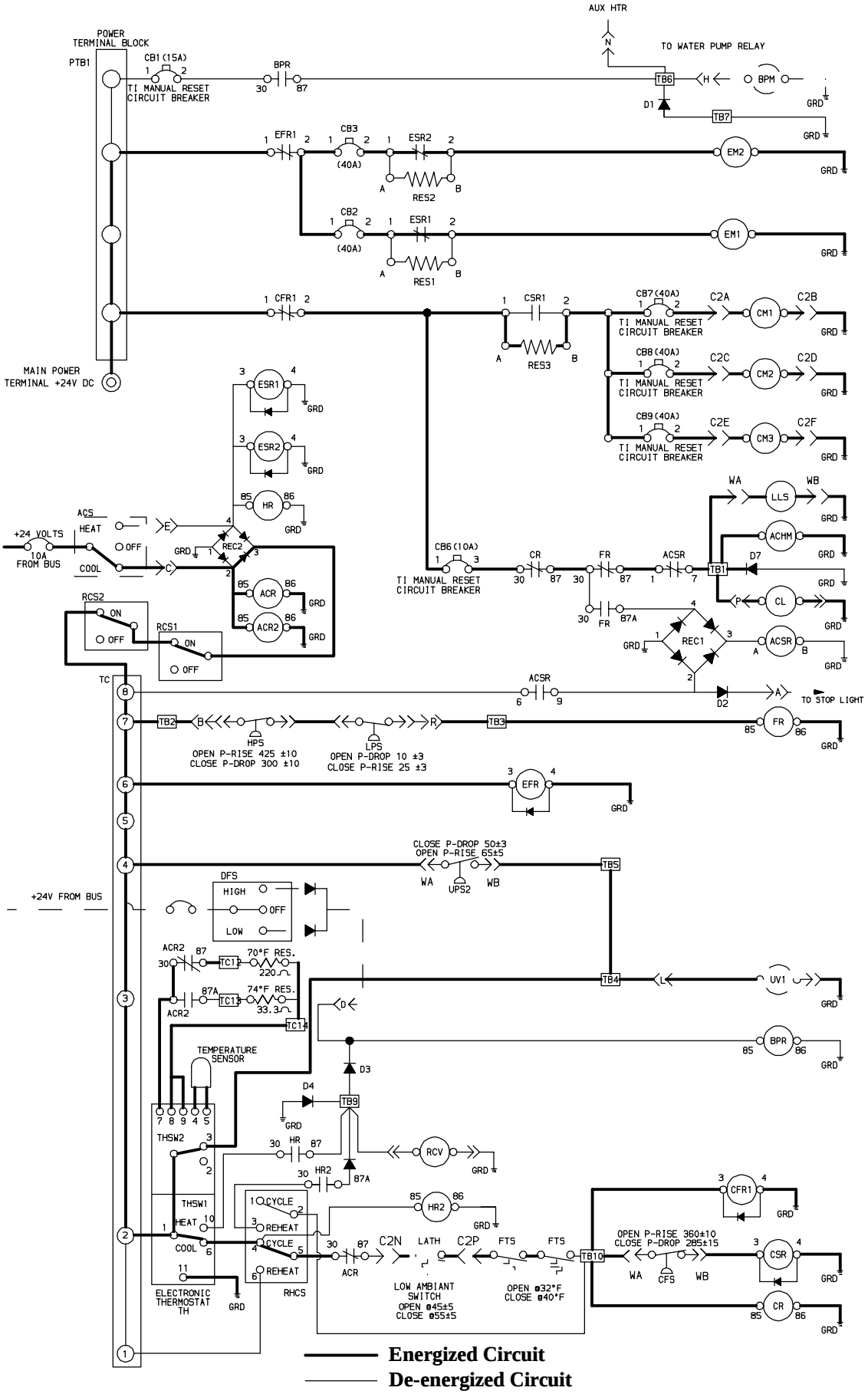


Figure 2-5. Rear Unit CYCLING CLUTCH, Air Conditioning – High Speed, Semi-Unloaded (3˚F Above Setpoint)

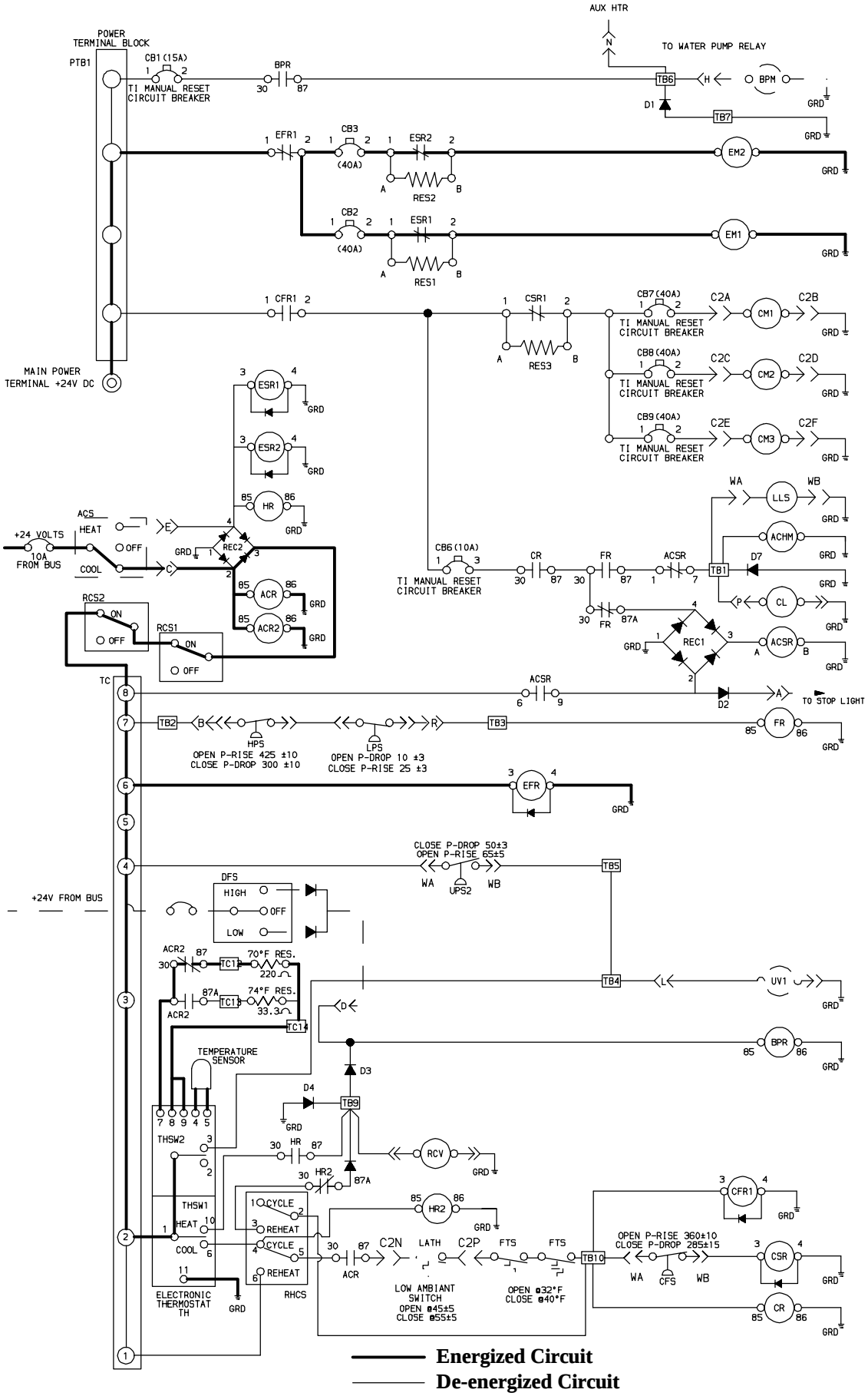


Figure 2-6. Rear Unit CYCLING CLUTCH, Air Conditioning Vent Mode – High Speed (Below 1˚F Above Setpoint)

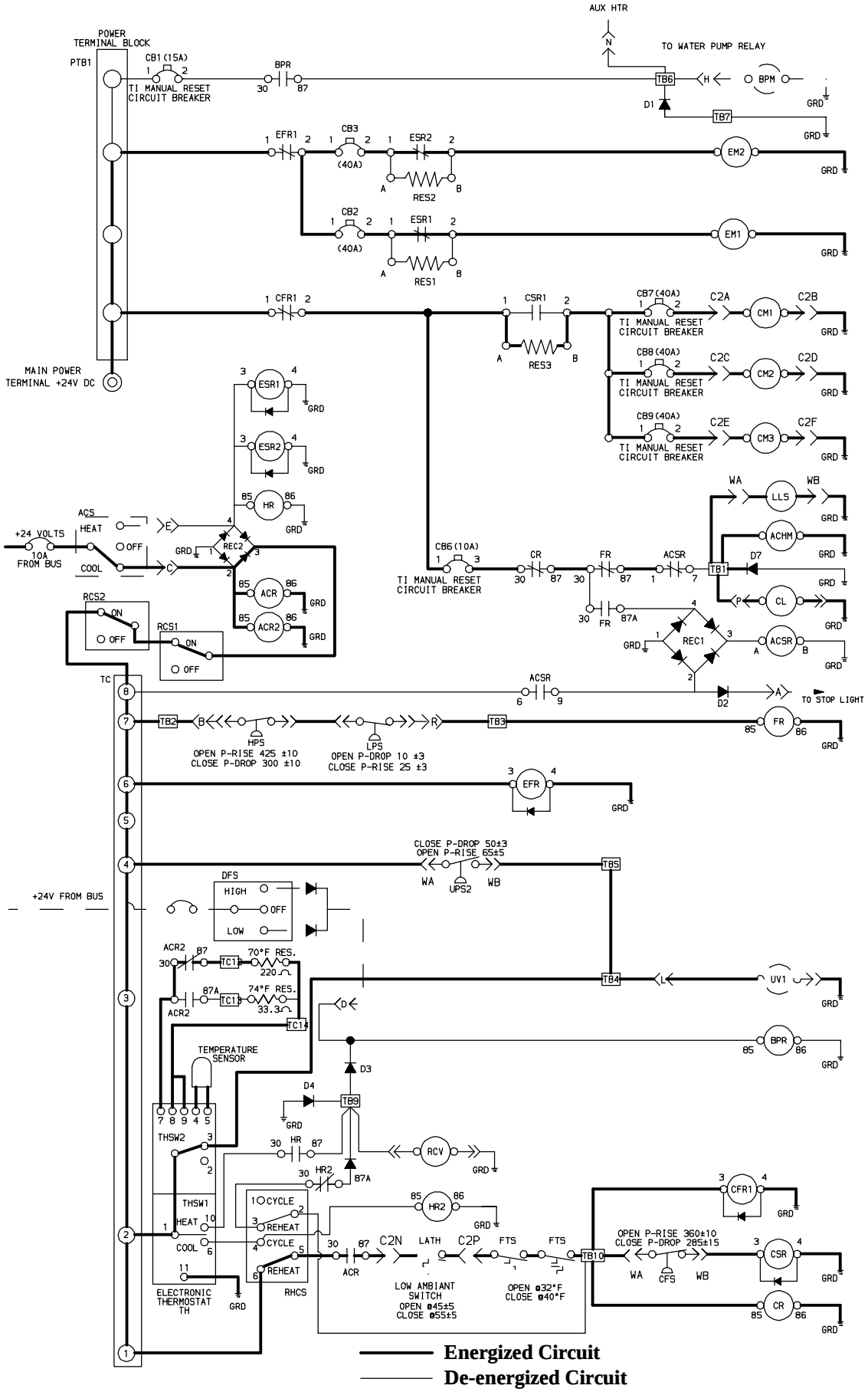


Figure 2-7. Rear Unit REHEAT, Air Conditioning Operation – High Speed, Semi-Unloaded (Above Setpoint)

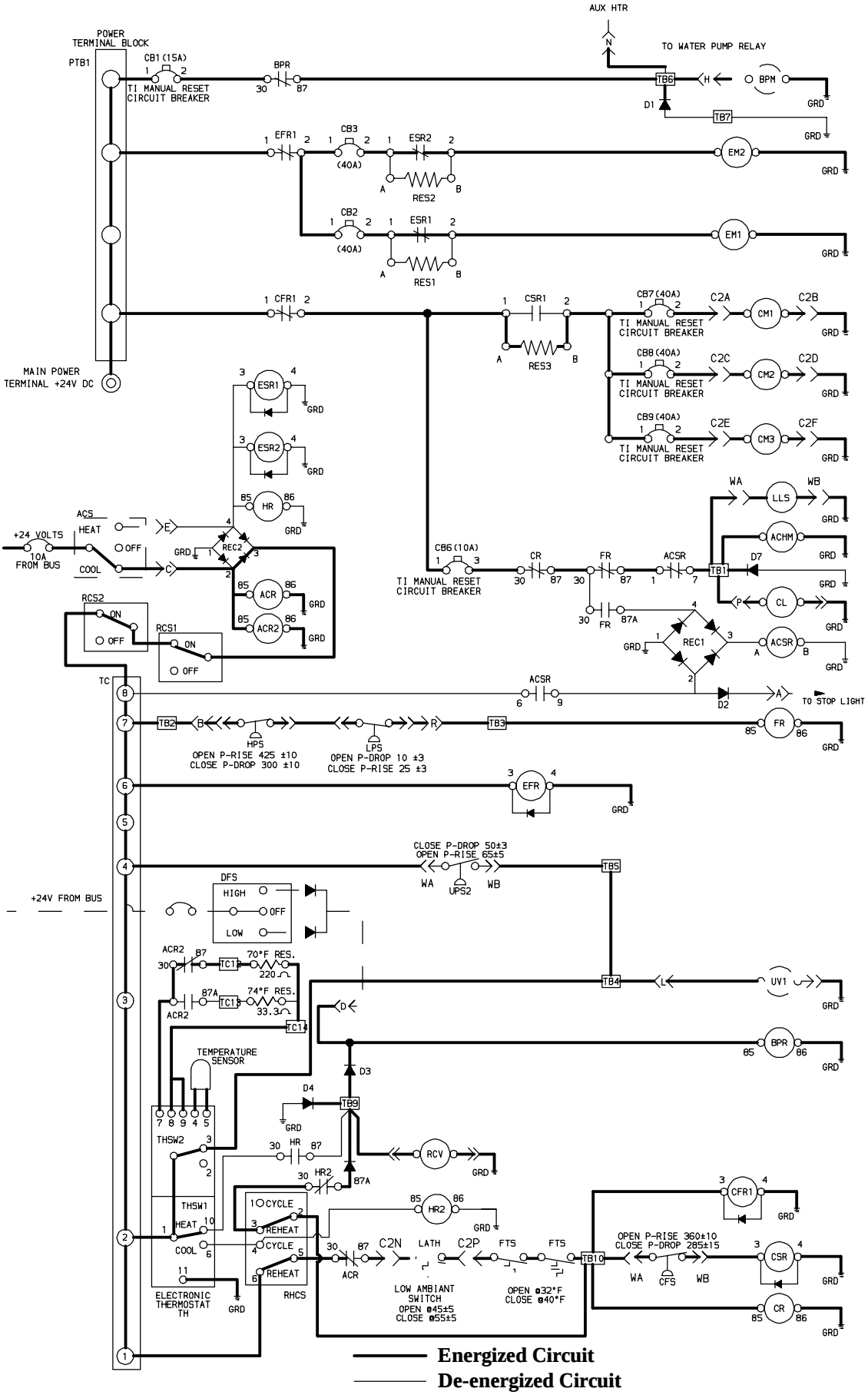


Figure 2-8. Rear Unit REHEAT, A/C with Reheat Mode – High Speed, Semi-Unloaded (2˚F Below Setpoint)

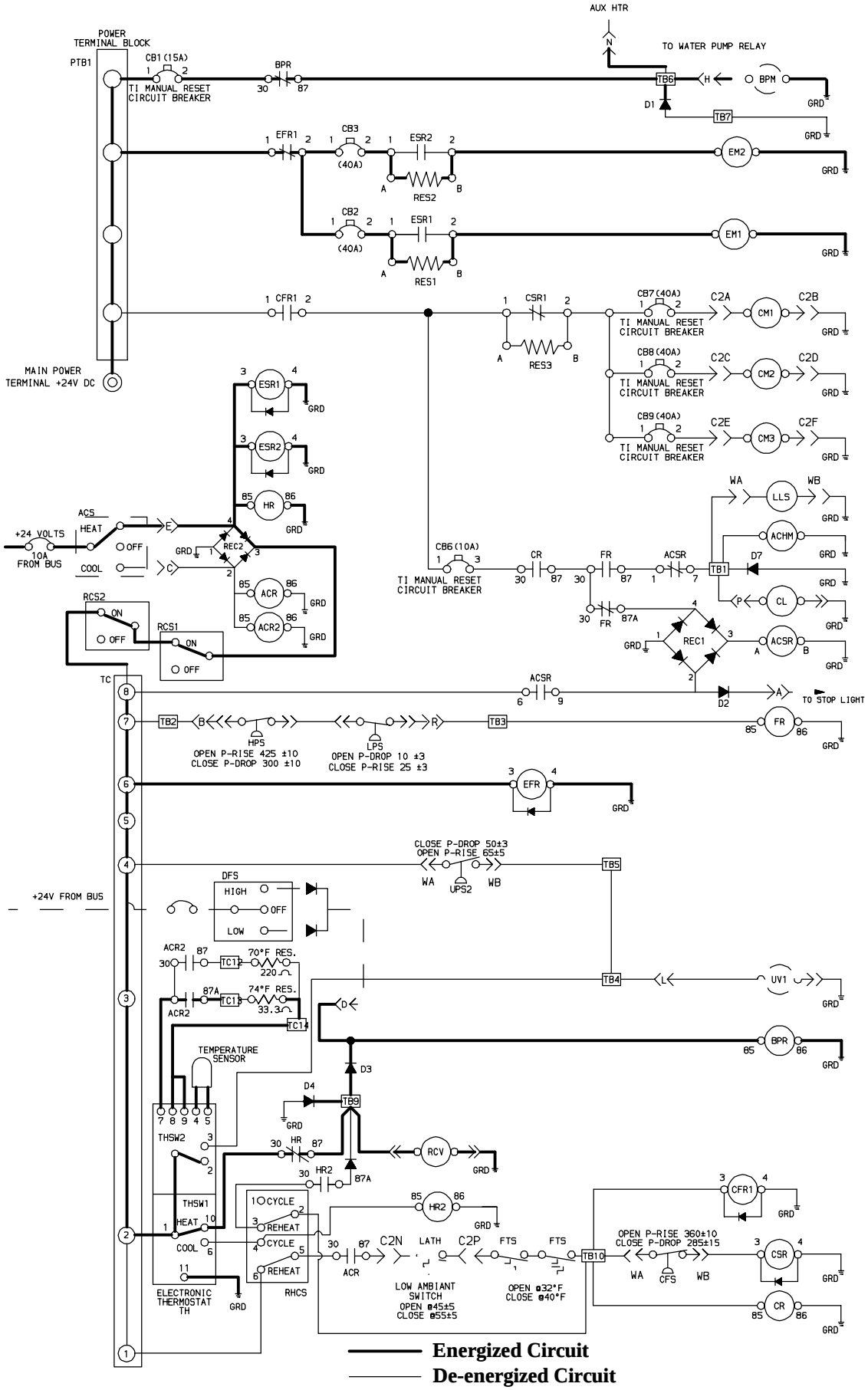


Figure 2-9. Rear Unit Heat Operation – Low Speed Mode (2˚F Below Setpoint)

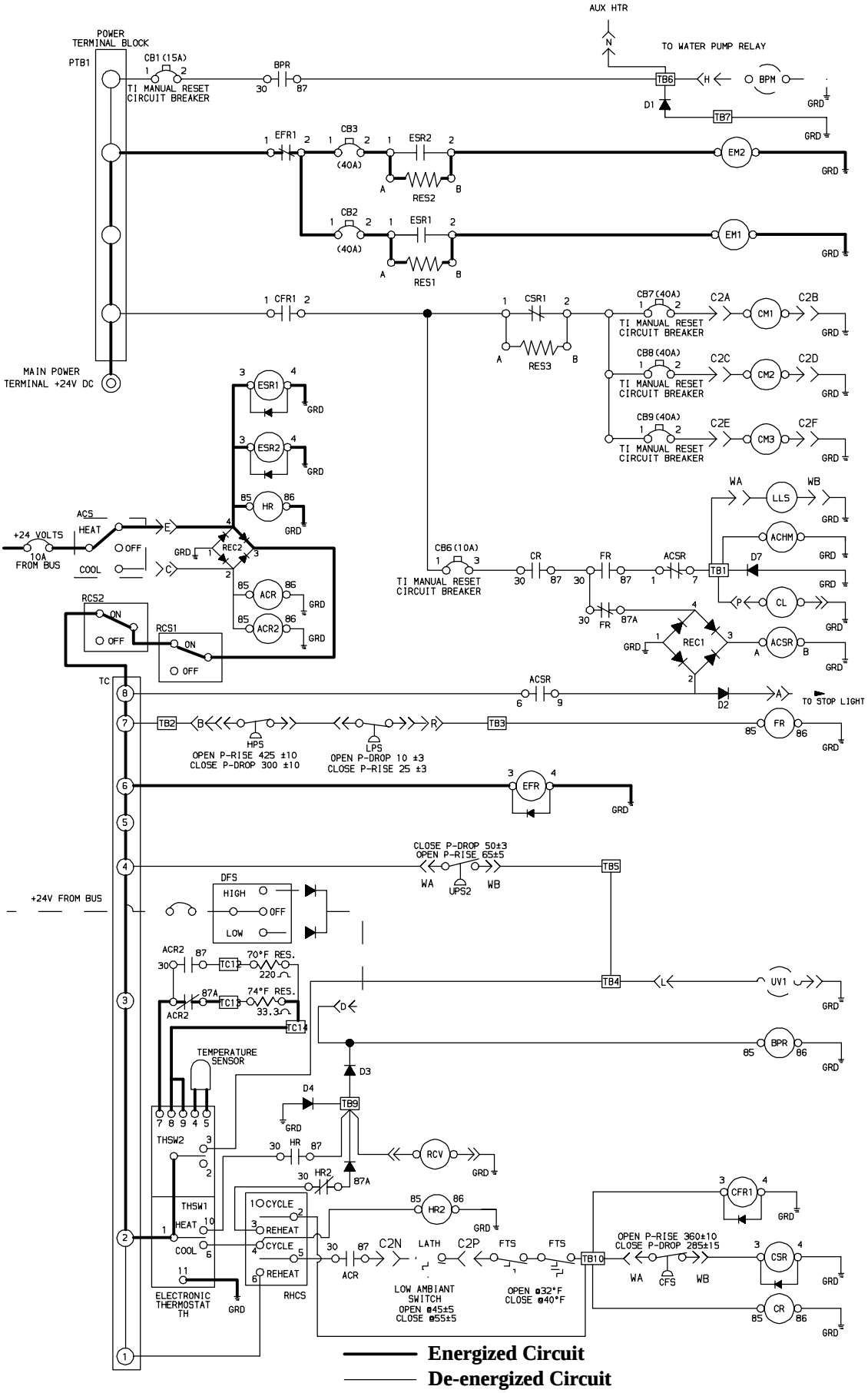


Figure 2-10. Rear Unit Heat Operation – Low Speed Vent Mode (At Setpoint)

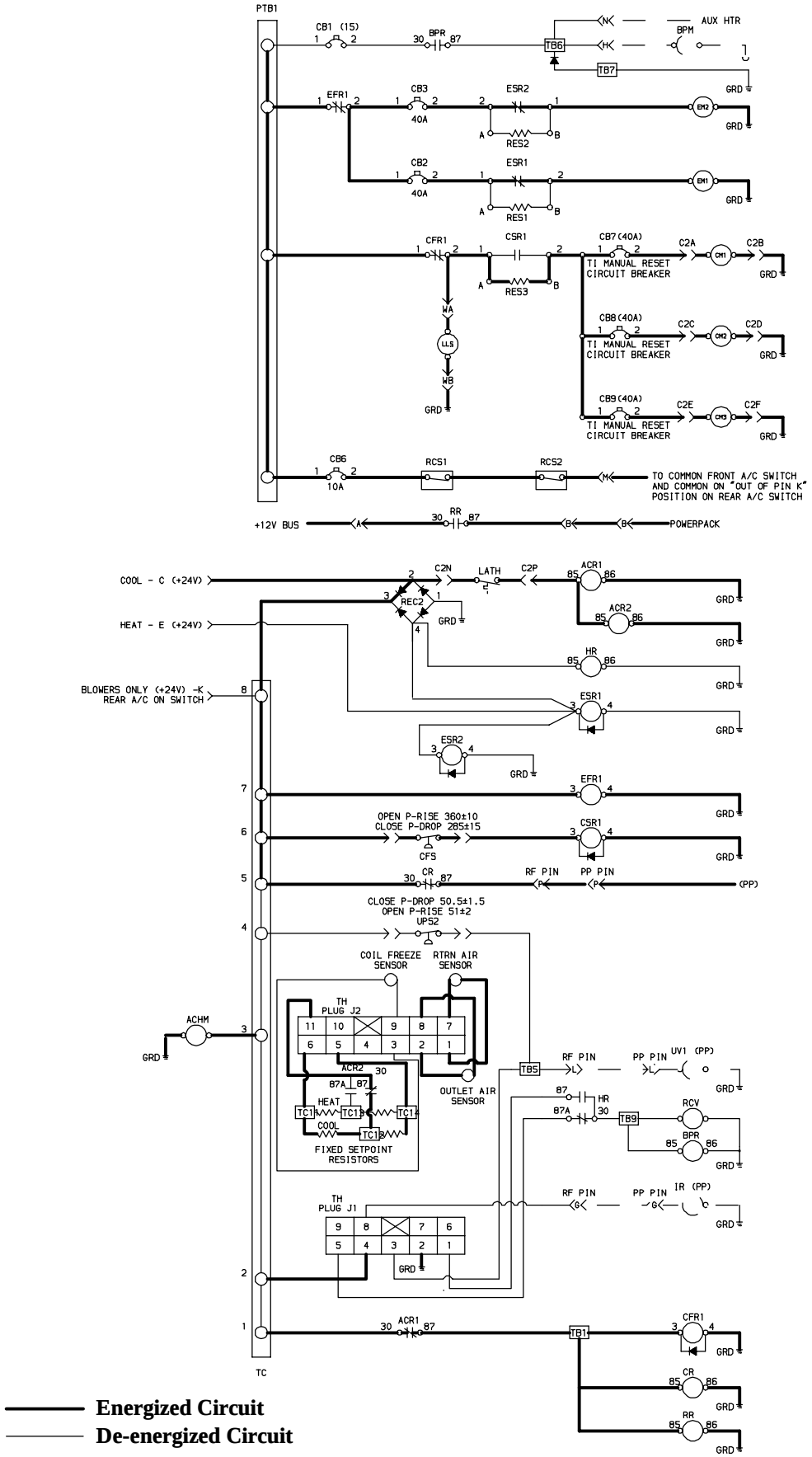


Figure 2-11. Front Unit – COOL

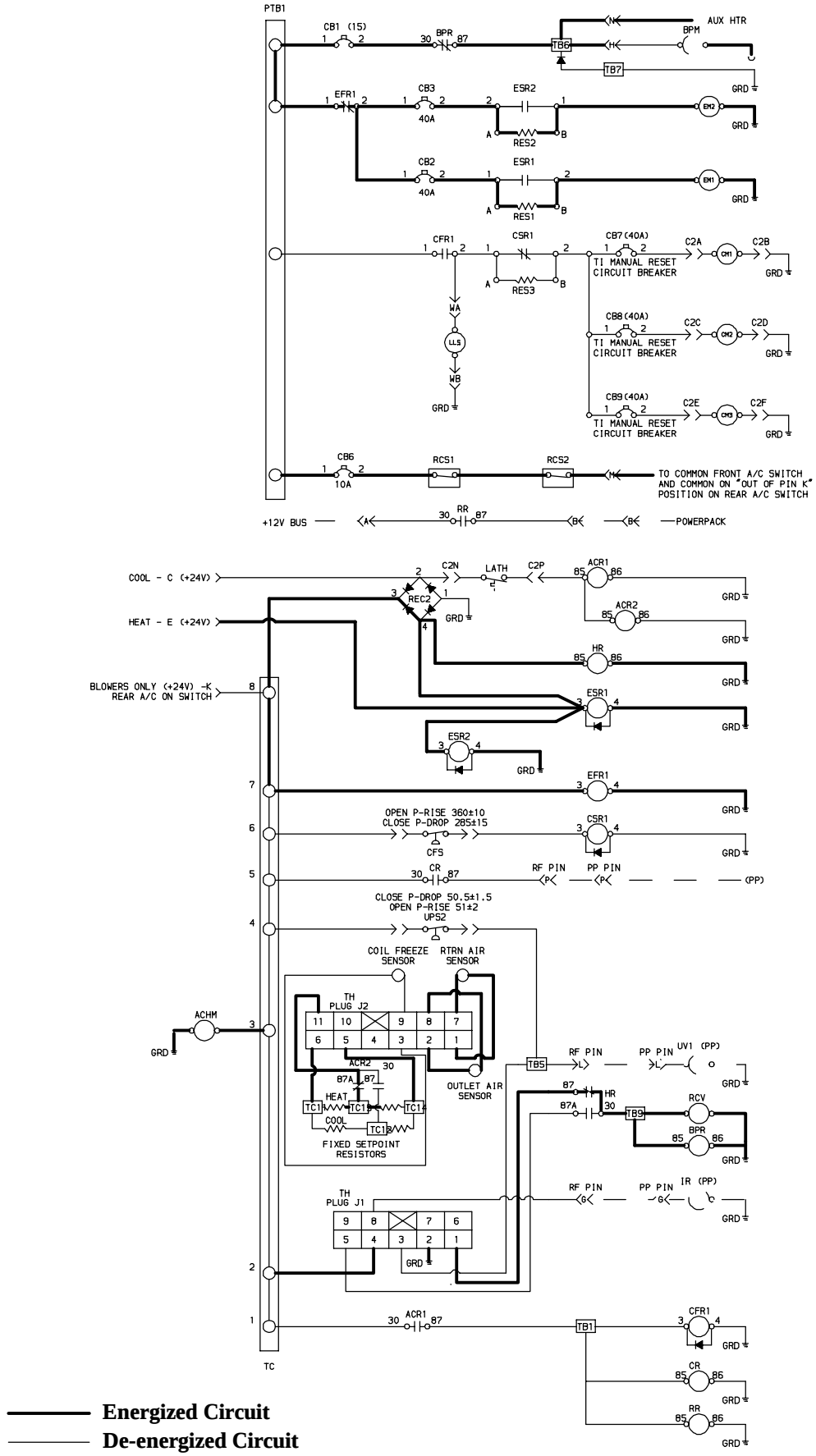


Figure 2-12. Front Unit – HEAT

SECTION 3

TROUBLESHOOTING

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.1 UNIT WILL NOT COOL		
Compressor will not run	V-Belt broke or defective	Check
	Compressor malfunction	See Note
	Clutch malfunction	Check/Replace
	Safety device open	1.4
Electrical malfunction	A/C Switch (ACS) defective	Check
	A/C Relay (ACR) defective	Check/2.3
	Low Ambient Thermostat (LATH) open	1.5.c
	Circuit breaker CB6 open	Check/Reset
	Temperature Controller malfunction	3.5
	Rear Control Switch (RCS) in OFF position	Check
	Liquid Line Solenoid (LLS) malfunction	4.16
3.2 UNIT RUNS BUT HAS INSUFFICIENT COOLING		
Compressor	Compressor valves defective	See Note
	V-belt loose	Check
Refrigeration system	Abnormal pressures	3.3
	No or restricted evaporator air flow	3.6
	Expansion valve malfunction	3.7
	Restricted refrigerant flow	3.7
	Low refrigerant charge	4.9
	Service valves partially closed	Open
	Safety device open	1.4
3.3 ABNORMAL PRESSURE		
High discharge pressure	Refrigerant overcharge	4.9
	Noncondensibles in system	Check Pressure
	Condenser fan motor rotation incorrect	Check/4.17
	Condenser coil dirty	Clean
Low discharge pressure	Compressor valves(s) worn or broken	See Note
	Low refrigerant charge	4.9
High suction pressure	Compressor valves worn or broken	See Note

NOTE: Refer to 05K Compressor manual, Form 62-02460.

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.3 ABNORMAL PRESSURE CONTINUED		
Low suction pressure	Suction service valve partially closed	Open
	Filter-Drier inlet and outlet valves partially closed	Check/Open
	Filter-drier partially plugged	4.10
	Low refrigerant charge	4.9
	Expansion valve malfunction	3.7
	Restricted air flow	3.6
	Liquid Line Solenoid (LLS) malfunction	4.16
Low evaporator air flow	Blower running in reverse	Check
	Dirty air filter	4.19
	Icing of coil	Clean
Suction and discharge pressures tend to equalize when unit is operating	Compressor valves defective	See Note
3.4 ABNORMAL NOISE AND VIBRATIONS		
3.4.1 ABNORMAL NOISE		
Compressor	Loose mounting bolts	Check
	Worn bearings	See Note
	Worn or broken valves	See Note
	Liquid slugging	
	Insufficient oil	4.20.3
	Clutch loose or rubbing	Check
Condenser or Evaporator fan	Loose or defective	4.17 & 4.18
	Bearings	Replace
	Blade Interference	4.17 & 4.18
	Blade broken or missing	4.17 & 4.18
3.4.2 ABNORMAL VIBRATION		
Compressor	Loose mounting bolts	Check
Evaporator or Condenser fan	Bent shaft on motor	4.17 & 4.18
	Blade broken or missing	4.17 & 4.18
3.5 TEMPERATURE CONTROLLER MALFUNCTION		
Will not control	Controller defective	1.5.a/Replace
	Sensor defective	Replace
	Defective wiring	Check

NOTE: Refer to 05K Compressor manual, Form 62-02460.

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.6 NO EVAPORATOR AIR FLOW OR RESTRICTED AIR FLOW		
No evaporator air flow	Motor burnout	4.18
	Fan damage	4.18
	Brushes defective	4.18
	Return air filter dirty	Check/4.19
	Evap Fan Relay EFR1 defective	Check/1.5
	Safety device open	1.4
	Wiring polarity incorrect	Check/5.1
3.7 EXPANSION VALVE MALFUNCTION		
Low suction pressure with high superheat	Low refrigerant charge	4.9
	Wax, oil or dirt plugging valve orifice	Check
	Ice formation at valve seat	4.7
	Superheat setting too high	4.12
	Power assembly failure	4.12
	Loss of bulb charge	4.12
	Broken capillary	4.12
	Loose bulb	Check
Low superheat and liquid slugging in compressor	Superheat setting too low	4.12
	Ice holding valve open	4.12
	Foreign material in valve	4.12
	Pin and seat of expansion valve eroded or held open by foreign material	4.12
	Broken capillary	4.12
Fluctuating suction pressure	Improper bulb location or loose bulb installation	4.12
	Low superheat setting	4.12
3.8 NO OR INSUFFICIENT HEATING		
Insufficient heating	Dirty or plugged heater coil	Check
	Coolant valve malfunction or plugged	4.15
	Low coolant level	Check
No heating	Reheat Coolant Valve RCV malfunction or plugged	4.15
	Controller malfunction	1.5.e/3.5
	Booster Relay BPR or Booster Pump malfunction	1.5.e/2.3.4
	Engine Coolant Switch (ECS) open	1.5.e/2.3.4
	Safety device open	1.4

SECTION 4

SERVICE

WARNING

BEWARE OF ROTATING FAN BLADES AND UNANNOUNCED STARTING OF FANS.

4.1 MAINTENANCE SCHEDULE

UNIT ON	UNIT OFF	OPERATION	REFERENCE SECTION
a. Daily Maintenance			
X		Pre-trip inspection – after starting	2.2
	X	Check tension and condition of Compressor V-belt(s)	None
b. Weekly Inspection and Maintenance			
	X	Perform daily inspection	4.1.a
	X	Check condenser, evaporator coils and air filters	None
	X	Check refrigerant hoses and compressor shaft seal for leaks	4.6
X		Feel filter-drier for excessive temperature drop across drier.	4.10
c. Monthly Inspection and Maintenance			
	X	Perform weekly inspection and maintenance	4.1.b
	X	Clean evaporator drain pan and hose(s)	None
	X	Check wire harness for chafing and loose terminals	Replace/Tighten
	X	Check fan motor bearings	None
	X	Check compressor mounting bolts for tightness	Check
d. Quarterly Inspection and Maintenance			
	X	Check fan motor brushes	4.18

4.2 SUCTION AND DISCHARGE SERVICE VALVES

The suction and discharge service valves used on the compressor are equipped with mating flanges for connection to flanges on the compressor. These valves are provided with a double seat and a gauge connection, which allow servicing of the compressor and refrigerant lines.

Turning the valve stem counterclockwise (all the way out) will *backseat* the valve to open the suction or discharge line to the compressor and close off the gauge connection. In normal operation, the valve is backseated to allow full flow through the valve. The valve should always be backseated when connecting the service manifold gauge lines to the gauge ports.

Turning the valve stem clockwise (all the way forward) will *frontseat* the valve to close off the suction or discharge line to isolate the compressor and open the gauge connection.

To measure suction or discharge pressure, midseat the valve by opening the valve clockwise 1/4 to 1/2 turn. With the valve stem midway between frontseated and backseated positions, the suction or discharge line is open to both the compressor and the gauge connection.

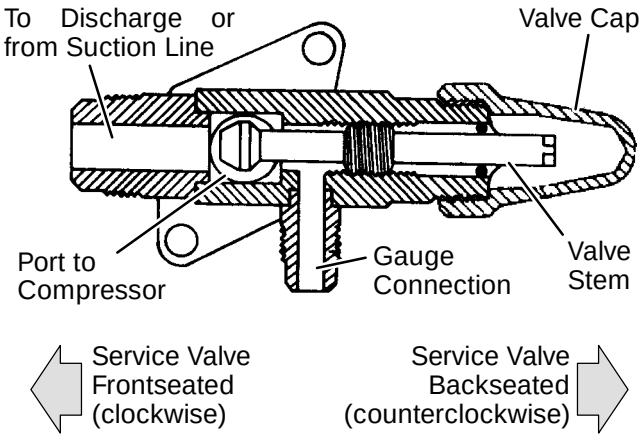


Figure 4-1. Suction or Discharge Service Valve

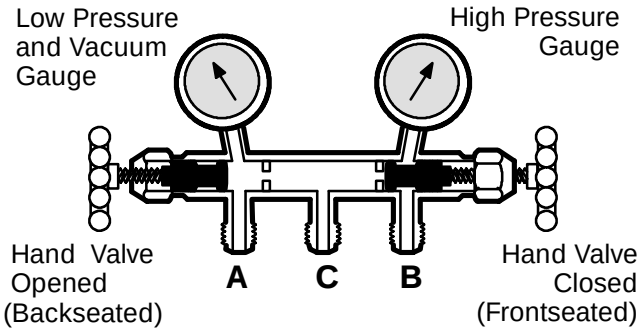
4.3 MANIFOLD GAUGE SET

The manifold gauge set can be used to determine system operating pressure, add a refrigerant charge, evacuate or equalize the system.

The manifold gauge in Figure 4-2 shows hand valves, gauges and refrigerant openings. When the manifold

hand valves are backseated (open), the high and low side hoses are common with the center hose as well as each other. When the low and high side valves are frontseated (closed), the high and low side hoses are isolated from each other and the center hose. It is in the front seated (closed) position that system pressures can be monitored. When both valves are open (backseated), pressure will cause vapor to flow from the high side to the low side across the compressor. When only the low side valve is opened, it is possible to add refrigerant in vapor form to the system.

If using R-134a, only an R-134a manifold gauge set with self-sealing hoses as shown in Figure 4-4 (CTD P/N 07-00294-00) can be used.



A. Hose Connection to Low Side of System

B. Hose Connection to High Side of System

C. Connection to/or for: Refrigerant Cylinder Oil Container

Figure 4-2. Manifold Gauge Set

a. Connecting the Manifold Gauge Set

To avoid the unsafe conditions near the running compressor, the recommended manifold gauge set connection is to the service ports located in end of return air opening. These service ports are located at the end of the unit control panel.

The control panel connections are equipped with schrader fittings which open when the connection is made.

1. Frontseat the manifold gauge hand valves to close off the center port.

2. Connect the high side hose *tightly* to the discharge drop tube service port.

3. Connect the low side hose *loosely* to the suction drop tube service port.

4. Loosen manifold gauge charging (center) hose at dummy fitting.

5. Open (counterclockwise) manifold discharge hand valve to purge discharge line through the center hose dummy fitting. Tighten the center hose dummy fitting.

6. Open (counterclockwise) manifold suction hand valve to purge suction hose. Tighten the suction hose fitting at the suction quick connect (schrader) fitting.

4.4 SYSTEM PUMP DOWN

To service or replace the filter-drier, expansion valve, evaporator coil, or suction line; pump the system refrigerant into condenser coil and receiver tank as follows:

a. Attach the manifold gauge as outlined in section 4.3. (See Figure 4-3 for R-22, Figure 4-4 for R-134a)

b. Disconnect low pressure switch quick connect. Install a jumper wire across switch connection to prevent the switch from disengaging the clutch.

c. Start the unit in A/C by placing the A/C Switch (ACS) in COOL position. The thermostat should be set below ambient temperature to ensure A/C operation.

d. Run unit for 5 – 10 minutes to allow system to stabilize.

e. Frontseat (close) the liquid line valve at the inlet of the filter-drier.

f. Observe the suction gauge. The pressure will drop off noticeably. Stop the unit when a 0 to 10 in. vacuum is reached.

g. Stop the unit. Observe the suction gauge. If the reading increases, restart the unit until the specified vacuum is achieved.

h. Repeat the above step until the specified vacuum is maintained after stopping.

i. Before opening the system a slight positive pressure (1-2 psig) is necessary to prevent air from being drawn into the system.

4.5 REMOVING REFRIGERANT CHARGE

A refrigerant recovery system is the recommended method for removing refrigerant charge. For the recovery system procedure, refer to instructions provided by the manufacture.

A refrigerant recovery system should always be used whenever removing contaminated refrigerant from the system.

If a recovery system is not available, proceed as follows:

Equipment Required

1. Appropriate evacuated returnable refrigerant cylinder, preferably a 60 – 120 lb net capacity may be used. Refrigerant removal will be faster and more complete with the larger cylinder.

WARNING

Do not use a disposable refrigerant container to store the refrigerant, an explosion may occur.

2. Manifold gauge set.

3. Vacuum pump, preferably 5 cfm (8 cu/H) or larger. CTD P/N 07-00176-01.

4. Weight scale (0 to 100 lb = 0 to 46 kg range, minimum).

5. A standard 1/4 in. charging hose.

To remove the refrigerant charge:

a. Install a manifold gauge set as outlined in section 4.3.

b. Connect evacuated refrigerant cylinder to the liquid line valve at the inlet valve of the filter-drier. The service line to the liquid valve of the cylinder should be attached loosely. Crack open the liquid line valve momentarily to purge service line at cylinder. Tighten connection at cylinder.

c. Place evacuated refrigerant cylinder on scale and note weight of empty cylinder. Leave cylinder on scale.

d. Frontseat liquid line valve at the inlet of the filter-drier.

e. Run the unit in high speed cool with the condenser coil completely blocked off. Head pressure will quickly rise. Stop the unit when the system pressure reaches 250 psig for R-22 systems or 150 psig for R-134a systems using the rear control switch (RCS).

f. Fully open the refrigerant cylinder liquid valve. Liquid refrigerant will flow from the liquid line valve to the cylinder. Head (discharge) pressure will drop.

g. Monitor weight of the refrigerant cylinder to determine how much refrigerant is being removed. Shut off cylinder valve when the scale weight has stabilized, indicating the refrigerant flow into the cylinder has stopped. Run the unit for a few more minutes to condense more liquid and raise head pressure.

NOTE

Refrigerant will flow from the system to the cylinder until the pressures equalize. It is possible to remove more refrigerant by cooling the refrigerant cylinder in a container of ice.

h. Backseat the liquid line valve and remove cylinder hose.

i. Service or replace the necessary component in the system.

NOTE

When opening up the refrigerant system, certain parts may frost. Allow the part to warm to ambient temperature before dismantling. This avoids internal condensation which puts moisture in the system.

4.6 REFRIGERANT LEAK CHECK

A refrigerant leak check should always be performed after the system has been opened to replace or repair a component.

To check for leaks in the refrigeration system, perform the following procedure.

a. If system is without refrigerant, charge system with refrigerant to build up pressure between 30 to 50 psig (2.1 to 3.5 kg/cm@).

NOTES

1. It must be emphasized that only the correct refrigerant be used to pressurize the system.

2. Under no circumstance should the system be pressurized above 100 psig when leak testing.

b. Check for leaks. The recommended procedure for finding leaks in a system is with a halide torch or electronic leak detector.

c. Remove refrigerant used to pressurize the system prior to leak repair using a refrigerant recovery system.

d. Repeat the entire procedure if necessary.

e. Evacuate and dehydrate the system as outlined in section 4.7.

f. Charge the unit as outlined in section 4.8.

4.7 EVACUATION AND DEHYDRATION

Proper evacuation and dehydration procedures are imperative when service repairs or component replacement are performed on the system to ensure proper unit performance and long compressor life.

The results of improper evacuation are harsh. Noncondensibles gases in the system result in high head pressure; moisture may cause ice blockage at the expansion valve; moisture and refrigerant may react to form an acid. This acid may cause copper plating of the bearing surfaces and eventual compressor failure.

a. Equipment Needed

1. **Vacuum Pump –** A good vacuum pump (3 to 5 cfm volume displacement, at atmospheric pressure) A pump of this capacity is available through the Carrier Service Parts, CTD P/N 07-00176-01.

2. **Thermistor Vacuum Gauge –** A thermistor vacuum gauge (electronic vacuum gauge) measures the low absolute pressures necessary to remove moisture from the system. *A compound gauge (manifold gauge set) is not recommended because of it's inherent inaccuracy.* A vacuum gauge is available from a refrigeration supplier.

3. **Evacuation Hoses –** Three 3/8" evacuation hoses, the length to be determined by the application of the service set-up. 3/8 to 1/4 adapter connector are also needed to make compressor connections. (Evacuation hoses and adapters are available from your local refrigeration supplier.) Do not use standard refrigeration hoses to evacuate. These standard hoses are designed for pressure not vacuum and may collapse during evacuation.

4. **Recovery System –** A refrigerant recovery system is recommended for removing the refrigerant.

5. **Evacuation Manifold –** A evacuation manifold is recommended for connecting the equipment needed for a proper evacuation. The evacuation manifold can be made easily as shown in Figure 4-3 for R-22. Figure 4-4 shows proper connections for R-134a.

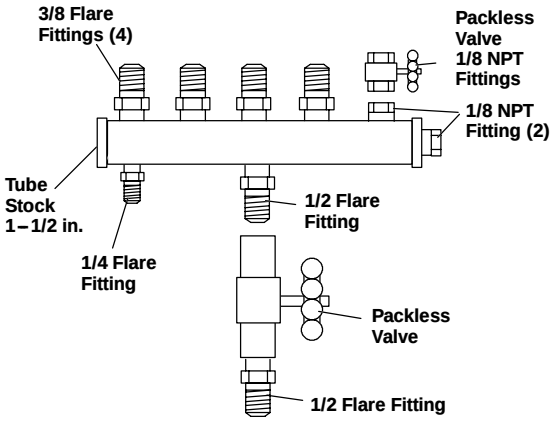


Figure 4-3. Evacuation Manifold – R-22

b. Evacuation Procedure

NOTE

When a low side pump down has been performed and after the low side has been evacuated the filter-dryer inlet valve needs to be opened. Also the liquid line solenoid valve needs to be manually energized.

To help speed up the evacuation process and to increase the evaporation of moisture, keep the ambient temperature above 60_F (15.6_C). If ambient temperature is lower than 60_F (15.6_C), ice may form before moisture removal is complete. Heat lamps or alternate sources of heat may be used to raise system temperature if necessary.

1. Before refrigerant removal and evacuation, leak test unit (refer to section 4.6).

2. Remove all remaining refrigerant charge in the system.

3. Connect evacuation manifold, vacuum pump, vacuum gauge, reclaimer and hoses as shown in Figure 4-5. All hand valves on manifold should be closed. The compressor service valves should be midseated if used. The reclaimer valve should be closed.

4. Start vacuum pump. Slowly open manifold valve to the pump. Open valve to the vacuum gauge.

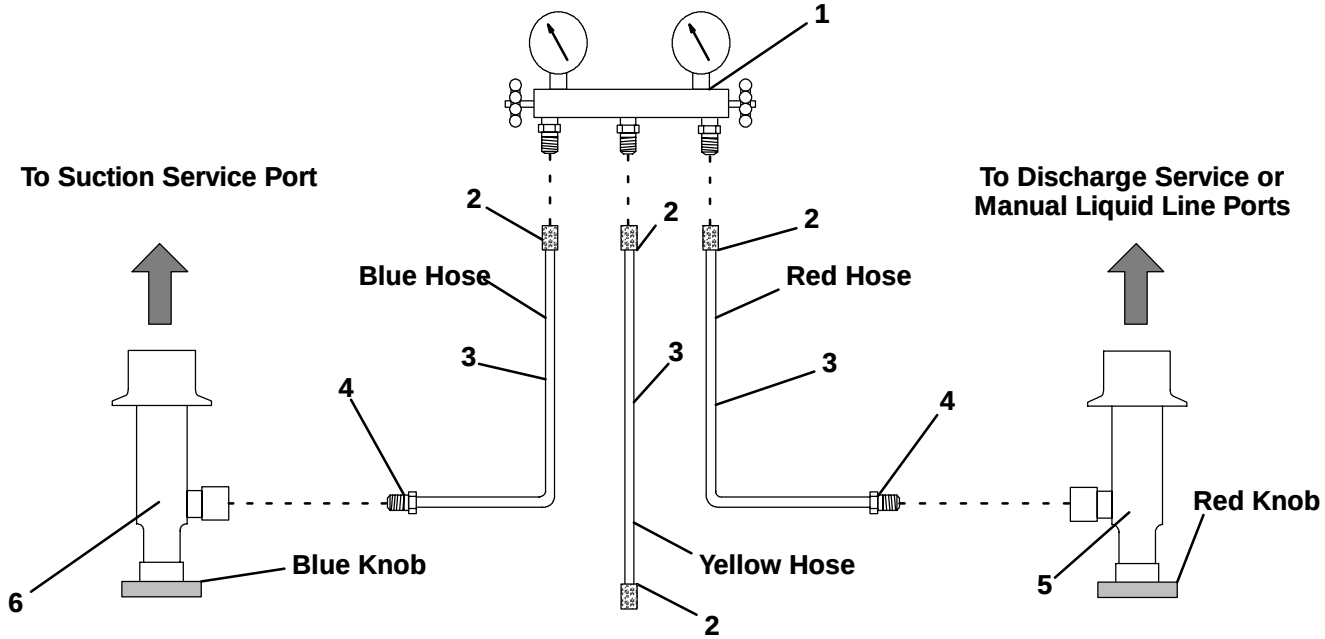
5. To open the liquid line solenoid valve (LLS), remove LLS-TB10 wire and supply 24 volts. Evacuate unit until vacuum gauge indicates 1500 microns (29.86 inches = 75.8 cm) Hg vacuum. Close gauge valve, vacuum pump valve, and stop vacuum pump.

6. Open the refrigerant cylinder vapor valve to break the vacuum. Raise the pressure approximately 2 psig. This will absorb any remaining moisture in the system for the second evacuation. Close the cylinder valve.

7. Repeat steps 4 and 5.

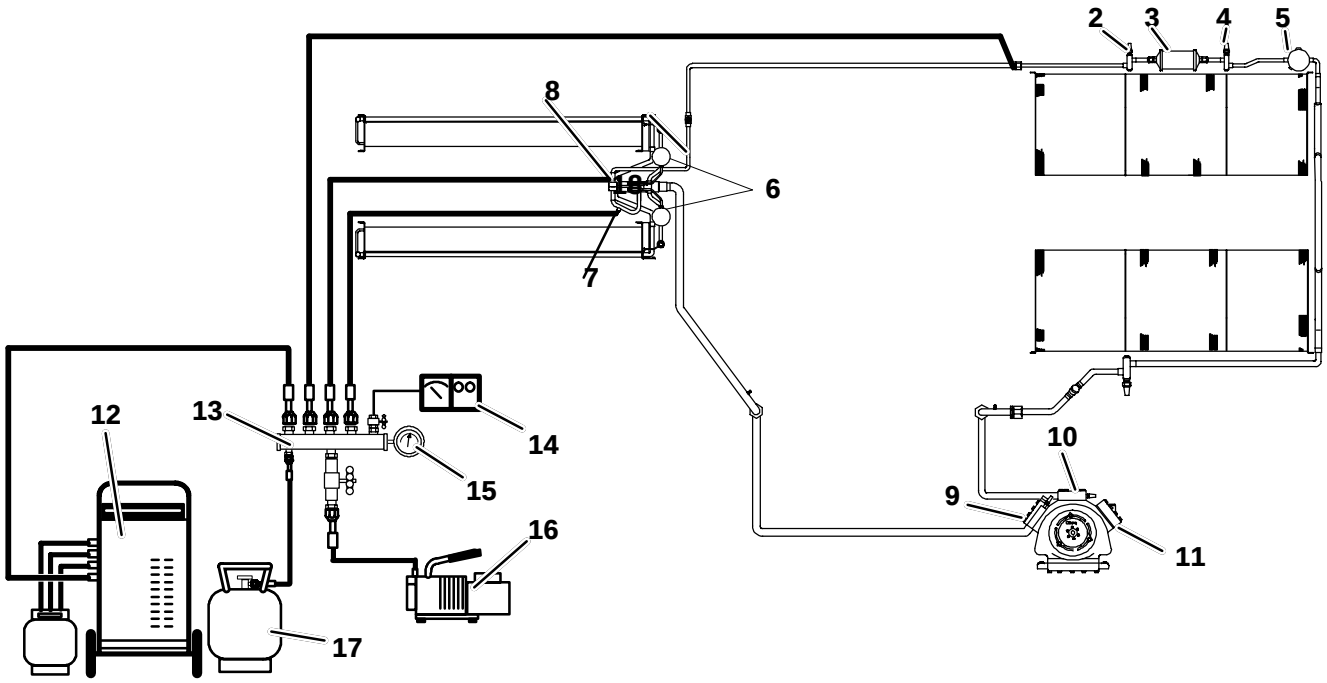
8. Evacuate again as described in step 3 to 300–500 microns Hg vacuum.

9. Charge the system to specifications through the refrigerant recovery machine (using manufactures charging procedure) or as outlined in section 4.8 (Charging the Refrigeration System).



1. Manifold Gauge Set
2. Hose Fitting (0.500-16 Acme)
3. Refrigeration or Evacuation Hoses (SAE J2196/R-134a)
4. Hose Fitting w/O-ring (M14 x 1.5)
5. High Side Field Service Coupling
6. Low Side Field Service Coupling

Figure 4-4. Manifold Gauge Set Connection – R-134a



1. Condenser Coils
2. Filter-Drier Outlet Service Valve
3. Filter-Drier
4. Receiver Outlet Valve
5. Receiver
6. Thermostatic Expansion Valves
7. High Pressure Service Port
8. Low Pressure Service Port
9. Discharge Service Valve
10. Suction Service Valve
11. Compressor
12. Reclaimer
13. Vacuum Manifold
14. Thermistor Vacuum Gauge
15. Compound Gauge
16. Vacuum Pump
17. Refrigerant Cylinder
18. Liquid Line Solenoid Valve

Figure 4-5. Evacuation Set-Up

4.8 ADDING REFRIGERANT TO SYSTEM

a. Installing a Full Charge

1. Install a manifold gauge set as outlined in section 4.3. (See Figure 4-3 for R-22, Figure 4-4 for R-134a)

2. Evacuate and dehydrate the system as outlined in section 4.7 if not completed at this time.

3. Place the appropriate refrigerant cylinder (R-22 or R-134a) on the scale and connect charging line from the cylinder to the filter-drier inlet valve. Purge charging line at valve.

4. Note weight of refrigerant cylinder.

5. Open liquid valve on refrigerant cylinder. Open filter-drier inlet valve half way and allow the liquid refrigerant to flow into the unit. Monitor weight of refrigerant cylinder to determine how much refrigerant is entering the system. The correct charge is 16 lbs.

6. When refrigerant cylinder weight (scale) indicates that the correct charge has been added, close liquid line valve at the cylinder and backseat the filter-drier inlet valve. Disconnect lines. Check refrigerant charge.

If the entire charge cannot be added, a partial charge may be necessary.

b. Adding a Partial Charge

1. Start the vehicle engine and allow unit to stabilize.

2. Place the appropriate refrigerant container (R-22 or R-134a) on the scale and connect charging hose from refrigerant cylinder vapor valve to the compressor suction service valve or the drop tube service port. Purge charging line.

3. Open the refrigerant cylinder vapor valve. Midseat suction valve (if used) and monitor the weight of the cylinder to add the remaining refrigerant. Disconnect cylinder.

4.9 CHECKING THE REFRIGERANT CHARGE

The following conditions must be met to accurately check the refrigerant charge.

1. Bus engine operating at high idle or Power Pack engine speed at 1900 rpm (high speed).

2. Unit operation in cool mode for 15 minutes.

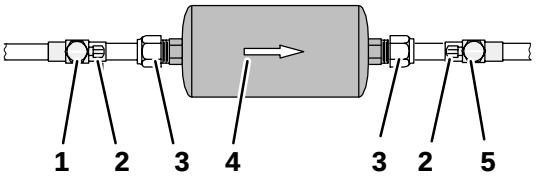
3. Head pressure at least 250 psig for R-22 systems or 150 psig for 134a systems. (It may be necessary to block condenser air flow to raise head pressure.)

a. Under the above conditions, the system is properly charged when the bottom receiver sight glass indicator ball is floating. If the bottom sight glass is not half full, add or delete refrigerant charge to the proper level.

4.10 FILTER-DRIER REMOVAL

If the sight glass on the receiver appears to be flashing or excessive bubbles are constantly moving through the sight glass, the unit may have a low refrigerant charge, or the filter-drier could be partially plugged.

If a pressure drop across the filter-drier is indicated or the moisture-indicator may show an abnormal (wet) condition, the filter-drier must be changed.



1. Filter-Drier Inlet Valve
2. Valve Service Port
3. Flare Nut
4. Filter-Drier
5. Filter-Drier Outlet Valve

Figure 4-6. Filter Drier Removal

a. Check for a restricted filter. Backseat the inlet and outlet valves of the filter-drier and attach the manifold gauge set. Midseat both valves and start unit. Observe the pressure reading. If a pressure drop of more than 10 psig is indicated the filter is plugged and must be changed.

b. Pump down the system as outlined in section 4.4.

c. Turn the A/C Switch (ACS) and Rear Control Switch (RCS) to the "OFF" position.

d. Place a new filter-drier near the unit for immediate installation.

CAUTION

The filter-drier may contain liquid refrigerant. Slowly open the flare nuts and avoid contact with exposed skin or eyes.

e. Using two open end wrenches, slowly crack open the flare nuts on each side of the filter-drier. After remaining refrigerant has escaped, remove the filter-drier.

f. Remove seal caps from the new filter-drier. Apply a light coat of compressor oil to the flares.

g. Assemble the new filter-drier to lines ensuring that the arrow on the body of the filter-drier points in the direction of the refrigerant flow (refrigerant flows from right to left as viewed). Finger tighten flare nuts.

h. Tighten filter-drier inlet line flare nut using two open end wrenches.

i. Open the filter-drier inlet valve slowly to purge the filter-drier momentarily. Tighten the outlet flare nut using two open end wrenches.

j. Immediately backseat (fully close both service valve ports) and replace valve caps.

k. Test filter-drier for leaks.

l. Check refrigerant level (refer to section 4.9).

4.11 CHECKING PRESSURE SWITCHES

The recommended procedure for testing the High Pressure Switch (HPS), Low Pressure Switch (LPS), Condenser Fan Speed Switch (CFS), and Unloader Pressure Switch #2 (UPS2) is to remove the switch from the unit and bench test as described in the following procedure.

All pressure switches are threaded into positive shut off connections (schrader) to allow easy removal and installation without pumping down or removing refrigerant from the unit. All wire leads to the switches are quick disconnects.

The High Pressure switch (HPS) (black wire leads) and Low Pressure switch (LPS) (red wire leads) are located on the compressor. The Condenser Fan Speed Switch (CFS) (gray wire leads) is located on the discharge line near the roadside evaporator fan blower assembly (see Figure 1-1). Unloader Pressure switch #2 (UPS2) (tan wire leads) is located on the suction line near the roadside evaporator fan blower assembly (see Figure 1-1).

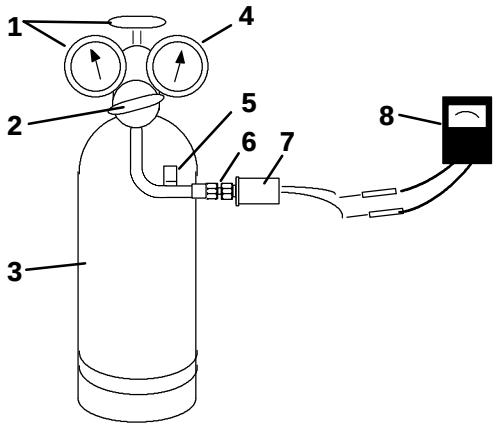
If the switch does not function as described below, the switch is defective and should be replaced.

a. Remove switch from the unit.

b. Connect an ohmmeter across switch leads (with no pressure applied to the switch). A continuity reading

should indicate a closed switch. If the switch is good, continue.

c. Connect switch to a cylinder of dry nitrogen as shown in Figure 4-7.



1. Cylinder Valve and Gauge
2. Pressure Regulator
3. Nitrogen Cylinder
4. Pressure Gauge (0 to 500 psig = 0 to 36 kg/cm@)
5. Bleed-Off Valve
6. 1/4 inch Connection
7. High or Low Pressure Switch
8. Ohmmeter

Figure 4-7. Checking High Pressure Switch

WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 psi (165 kg/cm@). Do not use oxygen in or near a refrigeration system as an explosion may occur.

d. Back-off regulator adjustment completely. Open the cylinder valve.

e. Slowly open the regulator valve to increase the pressure to the applicable pressures listed in Table 4-1 open or close the switch. If the ohmmeter reading does not correspond with the pressure listed in Table 4-1, the switch is defective and should be replaced.

f. Close cylinder valve and release the pressure through the bleed-off valve. As the pressure drops, the applicable switch will open or close. If the ohmmeter reading does not correspond with the pressure listed in Table 4-1, the switch is defective and should be replaced.

Table 4-1. Pressure Switch Continuity Check

	Ohmmeter Reading	
	No Continuity	Continuity
	Opens at	Closes at
R-22 Switches		
High Pressure (HPS)	425 ±10 psig	300 ±10 psig
Low Pressure (LPS)	13 ±3 psig	29 ±3 psig
Condenser Fan Speed (CFS)	360 ±10 psig	285 ±15 psig
Unloader Pressure #2 (UPS2)	65 ±5 psig	50 ±3 psig
134A Switches		
High Pressure (HPS)	300 ±10 psig	200 ±10 psig
Low Pressure (LPS)	13 ±3 psig	29 ±3 psig
Condenser Fan Speed (CFS)	250 ±10 psig	190 ±15 psig
Unloader Pressure #2 (UPS2)	40 ±10 psig	23 ±3 psig

4.12 THERMOSTATIC EXPANSION VALVE

The thermal expansion valve is an automatic device which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor. Unless the valve is defective, it seldom requires any maintenance.

a. Replacing the Expansion Valve

1. Pump down the unit. (Refer to section 4.4)

2. Remove left return air access panel.

3. Remove insulation (Presstite) from expansion valve bulb and remove from suction line.

4. Loosen flare nut and disconnect equalizer line from expansion valve.

5. Remove flange screws and lift off power head and cage assemblies. Check for foreign material in valve body.

6. Install new gaskets and assemble new cage and power head assemblies.

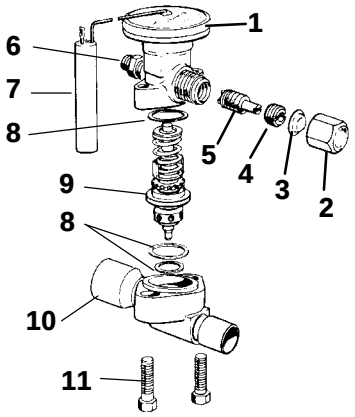
7. Attach the sensor bulb just below center of the suction line (4 or 7 o'clock position viewing from cross section to the suction line, see Figure 4-9). This area must be clean to ensure positive bulb contact. Do not insulate the bulb until the superheat is measured.

8. Fasten equalizer tube to expansion valve.

9. Evacuate by placing vacuum pump on the compressor suction service valve port or suction drop tube port (located in the engine compartment).

10. Open the inlet service valve to the filter-drier. Check refrigerant level. (Refer to section 4.9)

11. Check superheat.



1. Power Head
2. Cap Seal
3. Flare Seal
4. Retaining Nut
5. Adjusting Stem
6. Equalizer Connection
7. Sensor Bulb
8 Gasket
9. Cage Assembly
10. Body Flange
11. Capscrew

Figure 4-8. Thermostatic Expansion Valve

b. To Measure Superheat

NOTE

When conducting this test the suction pressure must be at least 6 psig (.42 kg/cm@) below the expansion valve maximum operating pressure (MOP). Refer to section 1.2.c for applicable valve settings.

1. Remove insulation from sensor bulb and suction line if installed..

2. Loosen one TXV bulb clamp and make sure area under clamp (above TXV bulb) is clean.

3. Place the temperature thermocouple above (parallel) TXV bulb and tighten loosened clamp making sure both bulbs are firmly secured to suction line as shown in Figure 4-9. Place insulation around TXV bulb and thermocouple.

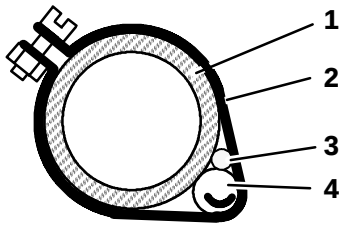
4. Connect suction gauge to the service port located on the suction line near the valve.

5. Set temperature controller to it's coolest setting. Run unit for at least 20 minutes to stabilize the system

6. Using the temperature/pressure chart (Table 4-2 or Table 4-3) for the applicable refrigerant used, determine the saturation temperature corresponding to the pressure taken at the suction service valve.

7. Note the temperature of the suction gas at the sensor bulb.

8. Subtract the saturation temperature determined in Step 6 from the average temperature measured in Step 7. The difference is the superheat of the suction gas.



1. Suction Line (end view)
2. Clamp
3. Thermocouple
4. TXV Sensor Bulb

Figure 4-9. Thermostatic Expansion Valve Bulb and Thermocouple

c. Adjusting Superheat

Refer to section 1.2.c for the superheat setting.

The thermostatic expansion valve used in this application is externally adjustable. The valve is preset at the factory and should not be adjusted unnecessarily. If necessary to adjust the superheat, proceed as follows:

1. Remove the seal cap to gain access to the superheat adjusting stem (see Figure 4-8).

2. Turn the adjusting stem clockwise to compress the valve spring which will decrease refrigerant flow through the valve, increasing superheat. Turn the adjusting stem counterclockwise to decompress the valve spring which will increase refrigerant flow through the valve, decreasing superheat.

3. When the unit has stabilized operation for at least 20 minutes, recheck superheat setting.

4. If superheat setting is correct, replace stem cap, remove gauge and thermocouple. Insulate bulb and suction line.

4.13 REMOVING THE HEATER COIL

a. Place the run control switch in the "OFF" position.

b. Open the air vent fitting at the top of the outlet header of the heater coil to bleed.

c. Drain coil by removing enough coolant from vehicle cooling system.

d. Disconnect water line from the coil.

CAUTION

If unit was recently operating, be careful of remaining hot coolant in the hoses when disassembling.

e. Remove coil retaining bolts on each side of the coil assembly (two each side). Pull top of coil assembly up and out to remove from unit.

f. Reverse procedure for installing new heater coil assembly.

4.14 REPLACEMENT OF EVAPORATOR COIL

a. If refrigerant remains in the system, perform a low side pump down, removing all refrigerant from the evaporator coils.

b. Using a 1/4I allen wrench, remove the three allen head bolts (1 bolt on the back end, and 2 on the front end) securing the heater coil to the evaporator coil that is to be removed.

c. Remove the TXV power head assembly and the TXV support bracket from the body of the TXV.

d. Remove the two bolts on the back end of the evaporator coil, securing coil to the evaporator sub-frame. From the inside of the coach, reaching up through return air opening, remove the two bolts at the front end of the evaporator coil securing it to the sub-frame.

e. Remove the panel covering the evaporator coil by loosening the phillips head screws along the overlapped edge of the control panel.

f. Unsolder the brazed inlet and outlet lines using caution with the flame of the brazing torch so that no damage is done to the unit's fiberglass shell.

g. Once the inlet and outlet lines are loose the evaporator coil can be lifted up and out of the unit.

h. To install replacement evaporator coil, reverse the above procedure.

4.15 SERVICING THE REHEAT COOLANT VALVE

The coolant valve requires no maintenance unless a malfunction to the internal parts or coil occurs. This may be caused by foreign material such as: dirt, scale, or sludge in the coolant system, or improper voltage to the coil.

To service the valve includes replacement of the internal parts shown in Figure 4-10 or the entire valve.

There are only three possible valve malfunctions: coil burnout, failure to open, or failure to close.

Coil burnout may be caused by the following:

1. Improper voltage.

2. Continuous over-voltage, more than 10% or Under-voltage of more than 15%.

3. Incomplete magnetic circuit due to the omission of the coil housing or plunger.

4. Mechanical interference with movement of plunger which may be caused by a deformed enclosing tube.

Failure to open may be caused by the following:

1. Coil burned out or an open circuit to coil connections.

2. Improper voltage.

3. Torn diaphragm.

4. Defective plunger or deformed valve body assembly.

Failure to close may be caused by the following:

1. Defective plunger or deformed valve body assembly.

2. Foreign material in the valve.

a. To replace a burnout coil, it is not necessary to drain the coolant from the system.

1. Place the run control switch in the "OFF" position.

2. Disconnect wire leads to coil.

3. Remove coil retaining screw and nameplate.

4. Lift burned-out coil from enclosing coil assembly and replace.

5. Connect wire leads and test operation.

b. To replace the internal parts of the valve:

1. Place the run control switch in the "OFF" position.

2. Open the vent fitting at the top of the outlet header of the heater coil.

3. Drain coil by removing enough coolant from vehicle cooling system.

4. Disassemble valve and replace defective parts.

5. Assemble valve and connect coolant hoses.

c. To replace the entire valve:

1. Drain coolant system and disconnect lines to valve as previously described.

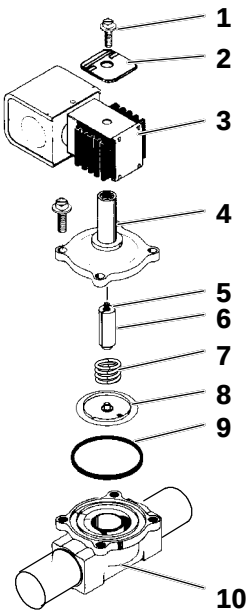
2. Disconnect wire leads to coil.

3. Remove valve assembly from bracket.

4. Install new valve and re-connect lines. It is not necessary to disassembly the valve when installing.

5. Fill system with coolant and bleed air through the vent fitting.

6. Connect wire leads and test operation.



1. Coil Retaining Screw
2. Nameplate
3. Coil Housing Assembly
4. Enclosing Tube & Bonnett Assembly
5. Kick-Off Spring
6. Plunger
7. Closing Spring
8. Diaphragm
9. O-Ring
10. Valve Body

Figure 4-10. Reheat Coolant Valve Assembly (RCV)

4.16 SERVICING THE LIQUID LINE SOLENOID VALVE

The Liquid line solenoid valve (LLS) is very similar to the reheat coolant valve (RCV). It requires no maintenance unless a malfunction to the internal parts or coil occurs. This may be caused by foreign material such as: dirt, scale, or sludge in the refrigeration system, or improper voltage to the coil.

Servicing the valve includes replacement of internal parts shown in Figure 4-11 or the entire valve.

There are only three possible valve malfunctions: coil burnout, failure to open, or failure to close. Coil burnout may be caused by the following:

1. Improper voltage.

2. Continuous over-voltage, more than 10% or under-voltage of more than 15%.

3. Incomplete magnet circuit due to the omission of the coil hosing or plunger.

4. Mechanical interface with movement of plunger which may be caused by a deformed enclosing tube.

Failure to open may be caused by the following:

1. Coil burned out or an open circuit to coil connections.

2. Improper voltage.

3. Torn diaphragm.

4. Defective plunger or deformed valve body assembly.

Failure to close may be caused by the following:

1. Defective plunger or deformed valve body assembly.

2. Foreign material in the valve.

a. To replace a burnout coil, it is not necessary to remove the refrigerant charge from the system.

1. Place the run control switch in the "OFF" position.

2. Disconnect wire leads to coil.

3. Remove coil retaining clip and nameplate.

4. Lift burned-out coil from enclosing coil assembly and replace.

5. Connect wire leads and test operation

b. To replace the internal parts of the valves

1. Place the run control switch in the "OFF" position.

2. Perform a low side pump down.

3. Disassemble valve and replace defective parts.

4. Assemble valve and leak check under valve while under pressure.

c. To replace the entire valve:

1. Perform a low side pump down and remove the lines to valve body.

2. Remove valve assembly from bracket.

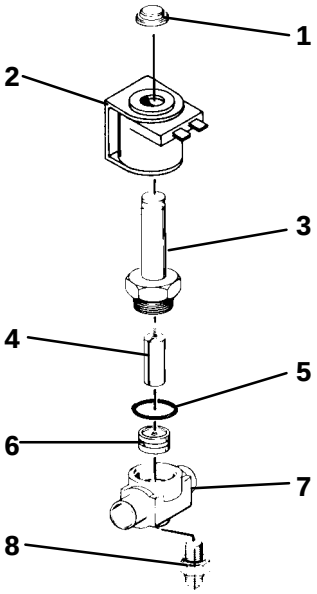
3. Disconnect wire leads to coil.

4. Install new valve and re-connect lines. It's necessary to disassemble the valve when soldering lines.

5. Leak check valve while under pressure.

6. Evacuate and charge system

7. Connect wire leads and test operation.



1. Snap Cap
2. Coil Assembly
3. Enclosing Tube Assembly
4. Plunger Assembly
5. Gasket
6. Piston Assembly
7. Body
8. Bracket Adapter

Figure 4-11. Liquid Line Solenoid Valve – Alco

4.17 REMOVING THE CONDENSER FAN MOTOR

a. Place run control switch to the OFF position.

b. Remove fan blade guard.

c. Remove the four motor mounting bolts from the bracket.

d. Disconnect motor wire harness and remove the motor by lifting the motor up and out.

e. To reassemble, reverse the above procedure.

4.18 SERVICING THE EVAPORATOR FAN BLOWER MOTOR ASSEMBLY

a. Removing and Disassembling

1. Place run control switch to the OFF position.

2. Disconnect the wire leads to the motor. Mark the leads for proper reassembly.

3. Remove motor mounting nuts from the bottom mounting studs.

4. From inside of the bus, remove the 8 bolts from each blower housing.

5. Also from inside of bus loosen the two blower hub set screws to remove blower. To do this a long handle 5/32I allen wrench is needed to reach blower hub through housing opening.

6. Slide loose housing off to side and then motor can be slid to side and lifted up to remove.

7. To reassemble, reverse the above procedure. Position blower in the center of the blower housing.

b. Routine Examination and Cleaning

1. At regular maintenance periods, remove brush covers and clean and examine motor interior.

2. Remove all foreign material, such as dirt and carbon dust with dry moderately compressed air. Clean by suction if possible to avoid blowing foreign matter into the motor.

3. Confirm free moving brushes to prevent binding.

4. Examine brush wear and general condition. If brushes are broken, cracked, severely chipped, or worn to 1/3 the length of a new brush, replace them. Refer to section 4.18.c.

5. Examine the condition of the brush springs. A discolored spring is a sign of overheating which may weaken the spring, in which case the spring should be replaced.

6. Observe the condition of the commutator and the armature coils that are visible.

c. Brush Replacement

If brushes are broken, cracked, severely chipped, or worn to 1/3 their original length, replace the brush lead assembly.

1. Remove brush covers.

2. With fingers or suitable hook, lift the brush spring end up so the brush may slide up and out of the holder. Loosen the brush screw to remove the brush shunt terminal. Remove brush.

3. To replace, lift brush spring and place brush in holder. Position spring end on top of the brush.

4. Connect the brush shunt terminal to its proper crossover with the brush screw loosely.

5. Assure positioning of brush to permit the brush shunt to travel freely in the holder slot as the brush wears. If it hangs up, commutator damage and motor failure will result.

6. Tighten the brush screw.

4.19 REPLACING THE RETURN AIR FILTERS

The return air filters are located in the return air opening inside the bus.

The filters should be checked periodically depending on operating conditions for cleanliness. A dirty air filter will restrict the air flow over the evaporator coil. This could cause insufficient cooling or heat and possible frost build up on the coil.

Remove filters as follows:

a. Remove the return air grille.

b. Turn the run control switch to OFF.

c. Loosen the filter retaining clips.

d. Remove the filter from the return air grille.

e. Reverse the procedure for installing the new filters.

4.20 COMPRESSOR

4.20.1 Replacing the Compressor

a. Removing

1. If compressor is inoperative and refrigerant pressure still exists, frontseat the suction and discharge service valves to isolate most of the refrigerant in the system from the compressor.

If the compressor runs, pump down the compressor by frontseating the suction service valve until the pressure drops to 1 psig, then stop the unit.

2. Slowly release compressor pressure to a recovery system.

3. Remove the suction and discharge service valves and disconnect the high and low pressure switches (HPS & LPS).

4. Loosen the compressor to allow removal of all belts from the compressor.

5. Disconnect the wire connections to the unloader.

6. Attach sling or other device to compressor to remove. The compressor weighs approximately 146 lbs.

7. Remove the clutch from the compressor.

NOTE

If the compressor is to be returned to the factory, drain oil from defective compressor before shipping.

b. Installing

NOTES

1. It is important to check the compressor oil level of the new compressor and fill if necessary.

2. The service replacement compressor is sold without shutoff valves (but with valve pads). These should be placed on the old compressor before shipping. Check oil level in service replacement compressor. If none add the applicable amount outlined in section 1.2.b.

1. The original unloader valve must be transferred to the replacement compressor. The plug arrangement removed from the replacement is installed in the original compressor as a seal. If piston is stuck, it may be extracted by threading a socket head cap screw into top of piston. A small teflon seat ring at bottom of piston must be removed.

2. Remove the high pressure switch and install on new compressor after checking switch setting (refer to section 4.11).

3. Install compressor in unit by reversing step 4.20.1.a. It is recommended using new locknuts when replacing compressor. Install new gaskets on service valves and tighten bolts uniformly.

4. Attach two lines (with hand valves near vacuum pump) to the suction and discharge service valves. Dehydrate and evacuate compressor to 500 microns (29.901 Hg vacuum = 75.9 cm Hg vacuum). Turn off valves on both lines to pump.

5. Fully backseat (open) both suction and discharge service valves.

6. Remove vacuum pump lines and install manifold gauges.

7. Start unit and check for noncondensibles

8. Check refrigerant level and add if necessary.

9. Check compressor oil level (refer to section 4.20.2). Add oil if necessary.

10. Check compressor unloader operation.

11. Check refrigerant cycles.

4.20.2 Checking the Compressor Oil Level

a. Operate the unit in high idle cooling for at least 20 minutes.

b. Check the oil sight glass on the compressor to ensure that no foaming of the oil is present after 20 minutes of operation. If the oil is foaming excessively after 20 minutes of operation, check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before adding oil.

c. Check the level of the oil in the sight glass with the compressor operating. The correct level should be between 1/4 and 1/2 of the sight glass. If the level is above 1/2, oil must be removed from the compressor. If the level is below 1/8, add oil to the compressor as outlined in the following section.

4.20.3 Adding Oil to the Installed Compressor

CAUTION

The appropriate compressor oil must be used according to the refrigerant used in the system. (Refer to section 1.2.b.)

Two methods for adding oil are the oil pump method and closed system method.

a. Oil Pump Method

1. Connect an oil pump to a one U.S. gallon (3.785 liters) refrigeration oil container. Using the Robinair compressor oil pump (Carrier Transicold P/N 14388) is recommended.

When the compressor is in operation, the pump check valve prevents the loss of refrigerant, while allowing servicemen to develop sufficient pressure to overcome the operating suction pressure to add oil as necessary.

2. Backseat suction service valve and connect oil charging hose to oil fill port (see Figure 4-13). Crack the

service valve and purge the oil hose at oil pump. Add oil as necessary.

b. Closed System Method

In an emergency where an oil pump is not available, oil may be drawn into the compressor through the suction service valve.

CAUTION

Extreme care must be taken to ensure the manifold common connection remains immersed in oil at all times. Otherwise air and moisture will be drawn into the compressor.

1. Connect manifold gauge set. Place center charging line into compressor oil container as shown in Figure 4-12. Slowly open discharge hand valve to purge line, then close.

2. Frontseat the suction service valve and place a jumper wire on the low pressure switch to by-pass the switch.

3. Start unit and pull crankcase pressure until suction pressure gauge indicates 5 inches/hg. Shut down unit.

4. Crack open manifold valve and allow vacuum in compressor to draw oil slowly into compressor. When level is just above one quarter glass, close manifold valve. Midseat the suction service valve. Remove the LPS jumper wire.

5. Start unit and check compressor oil level.

6. Backseat valve to remove hose from suction service valve and replace service valve caps.

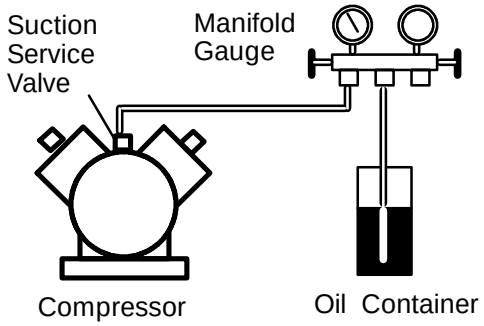


Figure 4-12. Compressor Oil Charge Connections

4.20.4 Adding Oil to Service Replacement Compressor

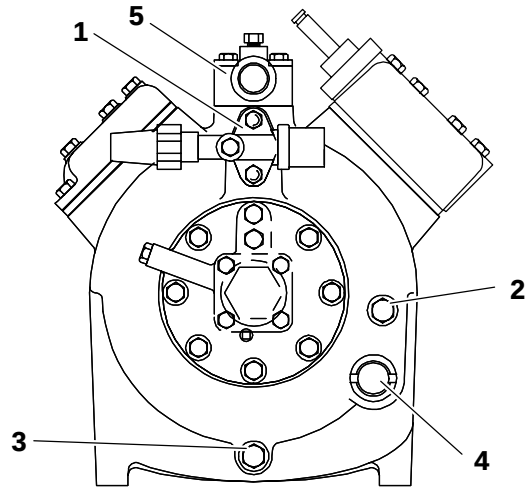
CAUTION

The appropriate compressor oil must be used according to the refrigerant used in the system. (Refer to section 1.2.b)

Service replacement compressors may or may not be shipped with oil.

If compressor is without oil:

Add correct oil, (section 1.2.b) through the suction service valve flange cavity or by removing the oil fill plug (see Figure 4-13, item 2).



1. Suction Service Valve
2. Oil Fill Plug
3. Oil Drain Plug
4. Oil Level Sight Glass
5. Discharge Service Valve

Figure 4-13. Compressor - Model 05K

a. To Remove Oil From the Compressor

1. If the oil level recorded in section 4.20.2 is above 1/2 of the sight glass, remove oil from the compressor. If at a full sight glass, remove 2-3/4 pints of oil from the compressor to lower the level to 1/2 of the sight glass.

2. Connect manifold gauges to the compressor.

3. Close suction service valve (frontseat) and pump unit down to 2 to 4 psig (.14 to .28 kg/cm@). Frontseat discharge service valve and slowly bleed remaining refrigerant.

4. Remove the oil drain plug from the compressor and drain the proper amount of oil. Replace the plug securely back into the compressor.

5. Repeat section 4.20.4.a.1. to ensure proper oil level.

NOTE

Before opening up any part of the system, *a slight positive pressure should be indicated on both gauges.* If a vacuum is indicated, emit refrigerant by cracking receiver outlet valve momentarily to build up a slight positive pressure.

Table 4-2. R-22 Temperature-Pressure Chart

TEMPERATURE		PRESSURE			TEMPERATURE		PRESSURE		
_F	_C	Psig	Kg/cm@	Bar	_F	_C	Psig	Kg/cm@	Bar
−40	−40	.6	.04	.04	34	1	60.5	4.25	4.17
−36	−38	2.3	.16	.16	36	2	63.3	4.45	4.36
−32	−36	4.1	.29	.28	38	3	66.1	4.65	4.56
−28	−33	6.0	.42	.41	40	4	69	4.85	4.76
−26	−32	7.0	.49	.48	44	7	75.0	5.27	5.17
−24	−31	8.1	.57	.56	48	9	81.4	5.72	5.61
−22	−30	9.2	.65	.63	52	11	88.1	6.19	6.07
−20	−29	10.3	.72	.71	54	12	91.5	6.43	6.31
−18	−28	11.5	.81	.79	60	16	102.5	7.21	7.07
−16	−27	12.7	.89	.88	64	18	110.2	7.75	7.6
−14	−26	14.0	.98	.97	68	20	118.3	8.32	8.16
−12	−24	15.2	1.07	1.05	72	22	126.8	8.91	8.74
−10	−23	16.6	1.17	1.14	76	24	135.7	9.54	9.36
− 8	−22	18.0	1.27	1.24	80	27	145	10.19	10.0
− 6	−21	19.4	1.36	1.34	84	29	154.7	10.88	10.67
− 4	−20	21.0	1.48	1.45	88	31	164.9	11.59	11.37
− 2	−19	22.5	1.58	1.55	92	33	175.4	12.33	12.09
0	−18	24.1	1.69	1.66	96	36	186.5	13.11	12.86
2	−17	25.7	1.81	1.77	100	38	197.9	13.91	13.64
4	−16	27.4	1.93	1.89	104	40	209.9	14.76	14.47
6	−14	29.2	2.05	2.01	108	42	222.3	15.63	15.33
8	−13	31.0	2.18	2.14	112	44	235.2	16.54	16.22
10	−12	32.9	2.31	2.27	116	47	248.7	17.49	17.15
12	−11	34.9	2.45	2.41	120	49	262.6	18.46	18.11
14	−10	36.9	2.59	2.54	124	51	277.0	19.48	19.10
16	− 9	39.0	2.74	2.69	128	53	291.8	20.52	20.12
18	− 8	41.1	2.89	2.83	132	56	307.1	21.59	21.17
20	− 7	43.3	3.04	2.99	136	58	323.6	22.75	22.31
22	− 6	45.5	3.2	3.14	140	60	341.3	24.0	23.53
24	− 4	47.9	3.37	3.3	144	62	359.4	25.27	24.78
26	− 3	50.2	3.53	3.46	148	64	377.9	26.57	26.06
28	− 2	52.7	3.71	3.63	152	67	396.6	27.88	27.34
30	− 1	55.2	3.88	3.81	156	69	415.6	29.22	28.65
32	0	57.8	4.06	3.99	160	71	434.6	30.56	29.96

Table 4-3. R-134a Temperature–Pressure Chart

BOLD NO. = Inches Mercury Vacuum (cm Hg Vac)

Temperature		Pressure			Temperature		Pressure		
_F	_C	Psig	Kg/cm@	Bar	_F	_C	Psig	Kg/cm@	Bar
–40	–40	**14.6**	**37.08**	**0.49**	30	–1	26.1	1.84	1.80
–35	–37	**12.3**	**31.25**	**0.42**	32	0	27.8	1.95	1.92
–30	–34	**9.7**	**24.64**	**0.33**	34	1	29.6	2.08	2.04
–25	–32	**6.7**	**17.00**	**0.23**	36	2	31.3	2.20	2.16
–20	–29	**3.5**	**8.89**	**0.12**	38	3	33.2	2.33	2.29
–18	–28	**2.1**	**5.33**	**0.07**	40	4	35.1	2.47	2.42
–16	–27	**0.6**	**1.52**	**0.02**	45	7	40.1	2.82	2.76
–14	–26	0.4	0.03	0.03	50	10	45.5	3.20	3.14
–12	–24	1.2	0.08	0.08	55	13	51.2	3.60	3.53
–10	–23	2.0	0.14	0.14	60	16	57.4	4.04	3.96
–8	–22	2.9	0.20	0.20	65	18	64.1	4.51	4.42
–6	–21	3.7	0.26	0.26	70	21	71.1	5.00	4.90
–4	–20	4.6	0.32	0.32	75	24	78.7	5.53	5.43
–2	–19	5.6	0.39	0.39	80	27	86.7	6.10	5.98
0	–18	6.5	0.46	0.45	85	29	95.3	6.70	6.57
2	–17	7.6	0.53	0.52	90	32	104.3	7.33	7.19
4	–16	8.6	0.60	0.59	95	35	114.0	8.01	7.86
6	–14	9.7	0.68	0.67	100	38	124.2	8.73	8.56
8	–13	10.8	0.76	0.74	105	41	135.0	9.49	9.31
10	–12	12.0	0.84	0.83	110	43	146.4	10.29	10.09
12	–11	13.2	0.93	0.91	115	46	158.4	11.14	10.92
14	–10	14.5	1.02	1.00	120	49	171.2	12.04	11.80
16	–9	15.8	1.11	1.09	125	52	184.6	12.98	12.73
18	–8	17.1	1.20	1.18	130	54	198.7	13.97	13.70
20	–7	18.5	1.30	1.28	135	57	213.6	15.02	14.73
22	–6	19.9	1.40	1.37	140	60	229.2	16.11	15.80
24	–4	21.4	1.50	1.48	145	63	245.6	17.27	16.93
26	–3	22.9	1.61	1.58	150	66	262.9	18.48	18.13
28	–2	24.5	1.72	1.69	155	68	281.1	19.76	19.37

SECTION 5

ELECTRICAL

5.1 INTRODUCTION

This section includes electrical wiring schematics for Model 68RF-50. The schematics shown in this section are for R-22 refrigerant systems. For R-134a systems, refer to section 1.2 for applicable switch setting.

LEGEND		
SYMBOL	DESCRIPTION	LOCATION
ACHM	A/C HOURMETER	C-6
ACS	A/C SWITCH (OFF-ON)	C-8
ACSR	A/C STOP RELAY (TIME DELAYED)	C-6
ACR	A/C RELAY	A-7, C-8
ACR2	A/C RELAY #2	B-8, C-8
BPM	BOOST PUMP MOTOR	D-6
BPR	BOOST PUMP RELAY	B-6, D-7
CB1	15A CIRCUIT BREAKER - MANUAL RESET	D-8
CB2	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB3	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB6	10A CIRCUIT BREAKER - MANUAL RESET	C-7
CB7	40A CIRCUIT BREAKER - MANUAL RESET	D-6
CB8	40A CIRCUIT BREAKER - MANUAL RESET	C-6
CB9	40A CIRCUIT BREAKER - MANUAL RESET	C-6
CFR1	CONDENSER FAN RELAY #1	A-6, D-7
CFS	CONDENSER FAN SPEED SWITCH (360 PSI)	A-6
CL	CLUTCH	C-6
CM1	CONDENSER FAN MOTOR #1	D-6
CM2	CONDENSER FAN MOTOR #2	C-6
CM3	CONDENSER FAN MOTOR #3	C-6
CR	CLUTCH RELAY	A-6, C-7
CSR	CONDENSER SPEED RELAY	A-6
CSR1	CONDENSER SPEED RELAY	D-7
DFS	DEFROST SWITCH (OPTIONAL)	B-8
D1-D10	DIODE	
EM1	EVAPORATOR FAN MOTOR #1	D-6
EM2	EVAPORATOR FAN MOTOR #2	D-6
EFR1	EVAPORATOR FAN RELAY	B-7, D-7
ESR1	EVAPORATOR SPEED RELAY	C-8, D-7
ESR2	EVAPORATOR SPEED RELAY	C-8, D-7
FR	FAULT RELAY	C-6
FTS	FREEZE THERMOSTAT SWITCH	A-7
HPS	HIGH PRESSURE SWITCH (425 PSI)	C-8
HR	HEAT RELAY	A-8, C-8
HR2	HEAT RELAY #2	A-7
LATH	LOW AMBIENT THERMOSTAT (OPTIONAL)	A-7
LLS	LIQUID LINE SOLENOID	C-6
LPS	LOW PRESSURE SWITCH	C-7
PTB1	POWER TERMINAL BLOCK	D-8
RCS1	REAR CONTROL SWITCH #1	C-8
RCS2	REAR CONTROL SWITCH #2	C-8
RCV	REHEAT COOLANT VALVE	A-7
REC1	RECTIFIER #1	C-6
REC2	RECTIFIER #2	C-8
RHCS	REHEAT/CYCLE SWITCH	A-8
TH	ELECTRONIC THERMOSTAT	A-8, B-8
THSW1	THERMOSTAT SWITCH (A/C-HEAT)	A-8
THSW2	THERMOSTAT SWITCH (UNLOADER)	A-8
UPS2	UNLOADER PRESSURE SWITCH #2	B-7
UV1	UNLOADER VALVE #1	B-6

NOTE:		
TC	TERMINAL BLOCK C (ON CONTROL PANEL)	A-8, B-8
TB	TERMINAL BLOCK B (ON CONTROL PANEL)	

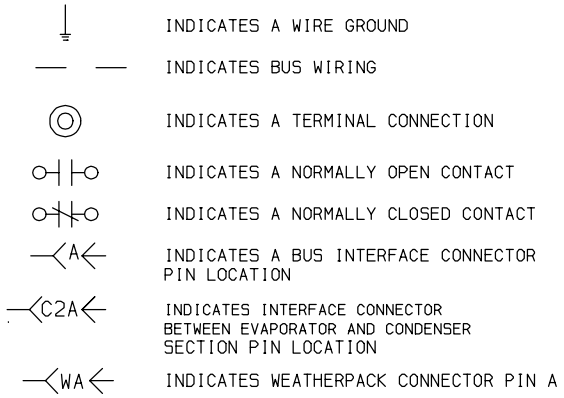

INDICATES A WIRE GROUND
INDICATES BUS WIRING
INDICATES A TERMINAL CONNECTION
INDICATES A NORMALLY OPEN CONTACT
INDICATES A NORMALLY CLOSED CONTACT
A
INDICATES A BUS INTERFACE CONNECTOR PIN LOCATION
C2A
INDICATES INTERFACE CONNECTOR BETWEEN EVAPORATOR AND CONDENSER SECTION PIN LOCATION
WA
INDICATES WEATHERPACK CONNECTOR PIN A

Figure 5-1. Electrical Wiring Schematic Diagram – Rear (68RF50 with Permanent Magnent Motors)
Dwg. No. C-070-913 Rev C (Sheet 1 of 2)

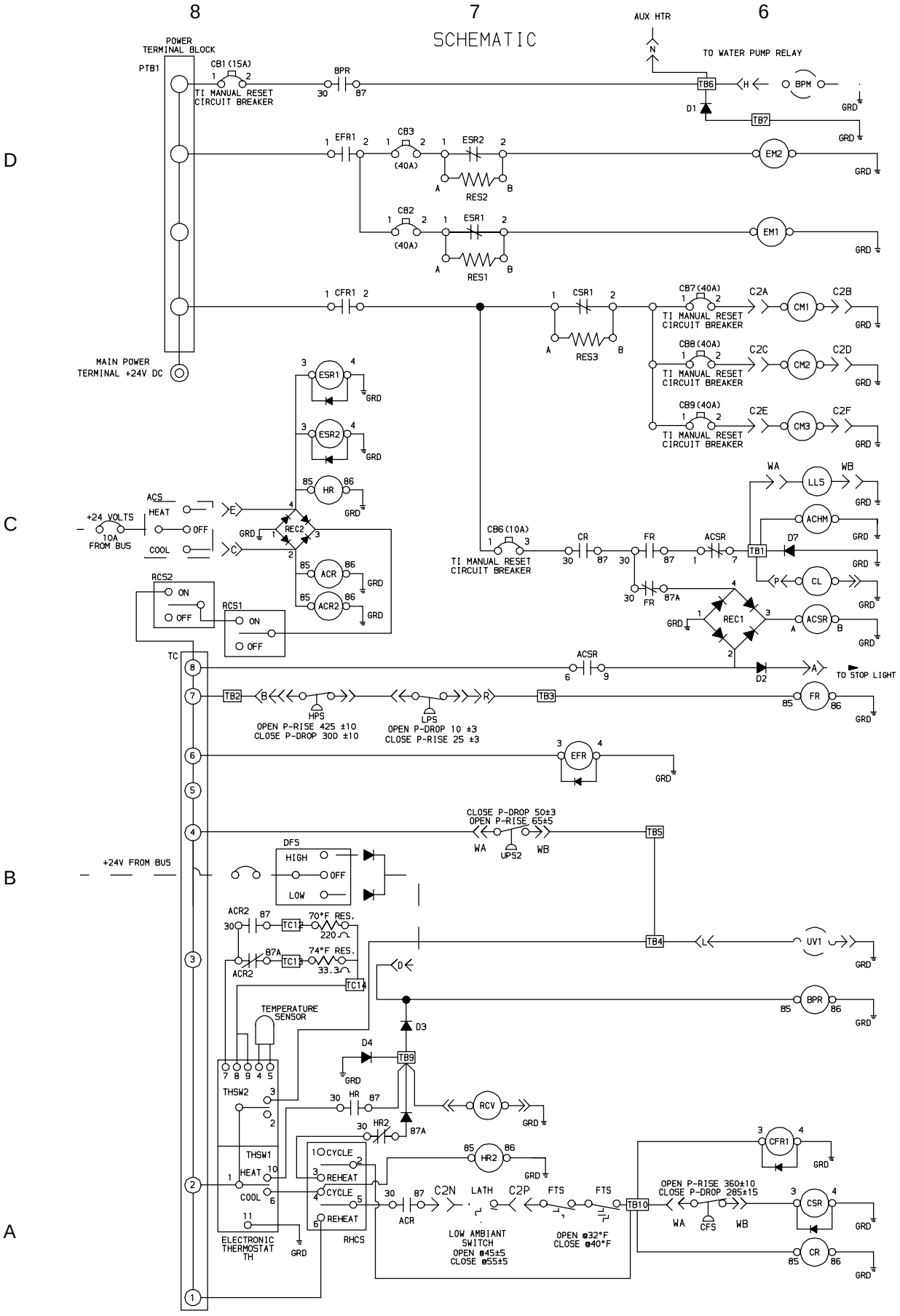


Figure 5-1. Electrical Wiring Schematic Diagram – Rear (68RF50 with Permanent Magnent Motors)
Dwg. No. C-070-913 Rev C (Sheet 2 of 2)

SYMBOL	DESCRIPTION	
ACHM	A/C HOURMETER	B-8
ACR1	A/C RELAY	A-7, C-7
ACR2	A/C RELAY #2	B-7, C-7
BPM	BOOST PUMP MOTOR	D-6
BPR	BOOST PUMP RELAY	A-6, D-7
C2A	EVAPORATOR/CONDENSER CONNECTOR PIN	
CB1	15A CIRCUIT BREAKER - MANUAL RESET	D-7
CB2	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB3	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB6	10A CIRCUIT BREAKER - MANUAL RESET	C-8
CB7	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB8	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB9	40A CIRCUIT BREAKER - MANUAL RESET	C-7
CFR1	CONDENSER FAN RELAY #1	A-6, D-7
CR	CONTROL RELAY	A-6, B-7
CFS	CONDENSER FAN SPEED SWITCH (360 PSI)	B-7
CM1	CONDENSER FAN MOTOR #1	D-6
CM2	CONDENSER FAN MOTOR #2	D-6
CM3	CONDENSER FAN MOTOR #3	C-6
CSR1	CONDENSER SPEED RELAY	B-7, D-7
D1-D10	DIODE	
EM1	EVAPORATOR MOTOR #1	D-6
EM2	EVAPORATOR MOTOR #2	D-6
EFR1	EVAPORATOR FAN RELAY #1	B-7, D-7
ESR1	EVAPORATOR SPEED RELAY #1	C-7, D-7
ESR2	EVAPORATOR SPEED RELAY #2	B-7, D-7
HR	HEAT RELAY	B-7, C-7
IR	IDLE RELAY	A-6
LATH	LOW AMBIENT THERMOSTAT	C-7
LLS	LIQUID LINE SOLENOID	D-7
PP	POWERPACK	A-6, B-6
PTB1	POWER TERMINAL BLOCK	C-8, D-8
RCS1	REAR CONTROL SWITCH #1	C-7
RCS2	REAR CONTROL SWITCH #2	C-7
RCV	RE-HEAT COOLANT VALVE	B-6
REC2	RECTIFIER #2	C-7
RR	RUN RELAY	A-6, C-7
TH	ELECTRONIC THERMOSTAT	A-7, B-7
UPS2	UNLOADER PRESSURE SWITCH #2	B-7
UV1	UNLOADER VALVE #1	B-6

NOTE:		
TC	TERMINAL BLOCK C (ON CONTROL PANEL)	A-8, B-8
TB	TERMINAL BLOCK B (ON CONTROL PANEL)	

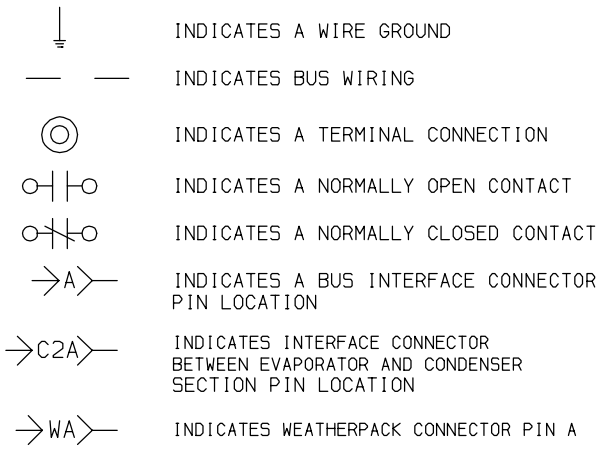

INDICATES A WIRE GROUND
INDICATES BUS WIRING
INDICATES A TERMINAL CONNECTION
INDICATES A NORMALLY OPEN CONTACT
INDICATES A NORMALLY CLOSED CONTACT
A
INDICATES A BUS INTERFACE CONNECTOR PIN LOCATION
C2A
INDICATES INTERFACE CONNECTOR BETWEEN EVAPORATOR AND CONDENSER SECTION PIN LOCATION
WA
INDICATES WEATHERPACK CONNECTOR PIN A

Figure 5-2. Electrical Wiring Schematic Diagram – Front (68RF50 with Permanent Magnet Motors)
Dwg. No. D-070-912 Rev D (Sheet 1 of 2)

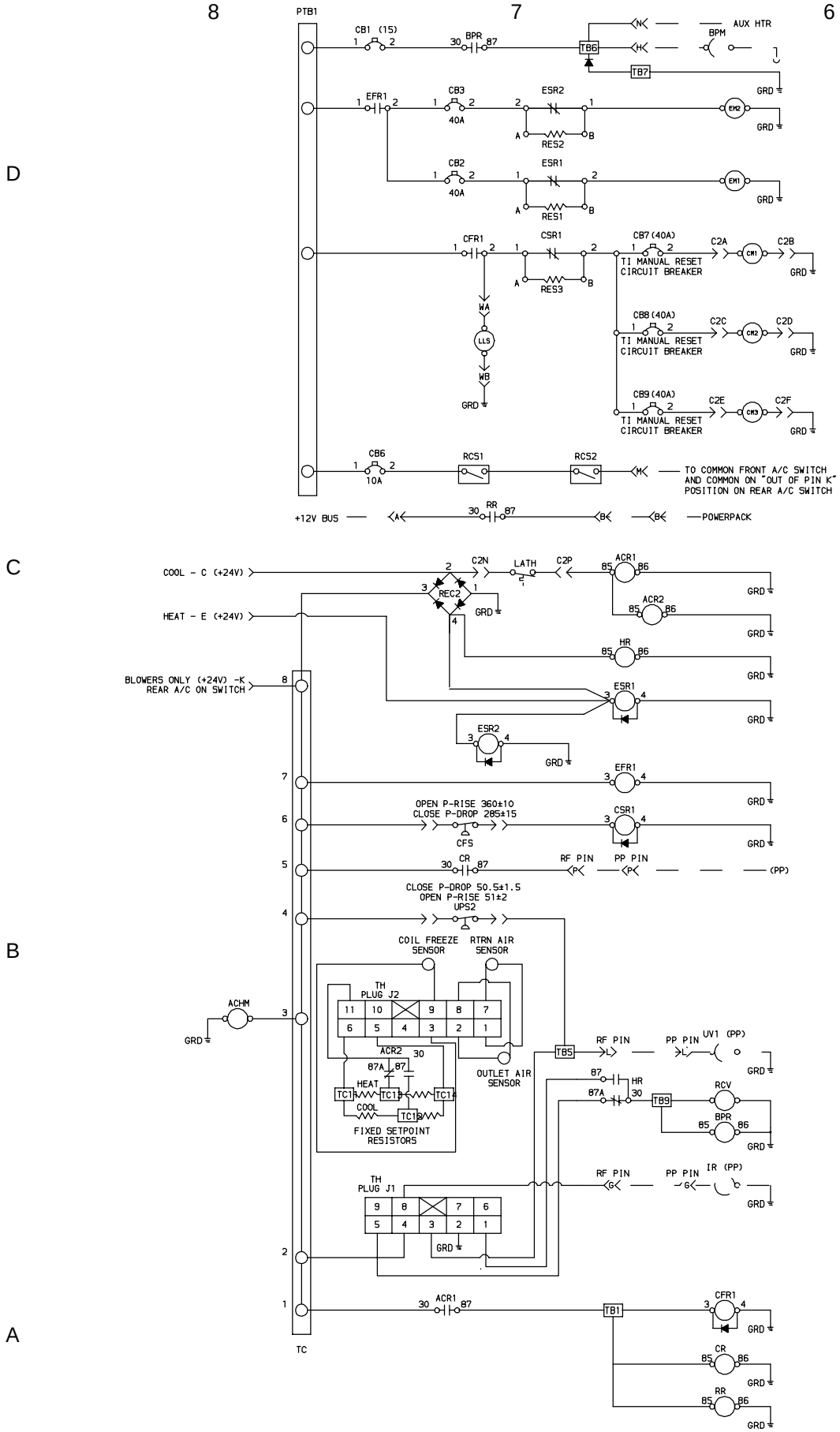


Figure 5-2. Electrical Wiring Schematic Diagram – Front (68RF50 with Permanent Magnet Motors)
Dwg. No. D-070-912 Rev D (Sheet 2 of 2)

SYMBOL	DESCRIPTION	
ACHM	A/C HOURMETER	C-6
ACR1	A/C RELAY #1	C-8
ACR2	A/C RELAY #2	B-8, C-8
ACS	A/C SWITCH (OFF-ON)	C-8
ACSR	A/C STOP RELAY (TIME DELAYED)	C-6, C-7
BPM	BOOST PUMP MOTOR	D-6
BPR	BOOST PUMP RELAY	B-6, D-7
C2A	EVAPORATOR/CONDENSER CONNECTOR PIN	
CB1	15A CIRCUIT BREAKER - MANUAL RESET	D-8
CB2	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB3	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB6	10A CIRCUIT BREAKER - MANUAL RESET	C-7
CB7	40A CIRCUIT BREAKER - MANUAL RESET	D-8
CB8	40A CIRCUIT BREAKER - MANUAL RESET	D-8
CB9	40A CIRCUIT BREAKER - MANUAL RESET	C-8
CFR1	CONDENSER FAN RELAY #1	A-6, D-7
CFR2	CONDENSER FAN RELAY #2	A-6, D-7
CFR3	CONDENSER FAN RELAY #3	B-6, C-7
CFS	CONDENSER FAN SPEED SWITCH (360 PSI)	A-6
CL	CLUTCH	C-6
CM1	CONDENSER FAN MOTOR #1	D-6
CM2	CONDENSER FAN MOTOR #2	D-6
CM3	CONDENSER FAN MOTOR #3	C-6
CR	CONTROL RELAY	A-6, C-7
CSR1	CONDENSER SPEED RELAY	A-6, D-6
D1-D10	DIODE	
DFS	DEFROST SWITCH	B-8
EM1	EVAPORATOR MOTOR #1	D-6
EM2	EVAPORATOR MOTOR #2	D-6
EFR1	EVAPORATOR FAN RELAY #1	B-7, D-7
ESR1	EVAPORATOR SPEED RELAY #1	C-8, D-6
FR	FAULT RELAY	C-6
FTS	FREEZE THERMOSTAT SWITCH	A-7
HRS	HIGH PRESSURE SWITCH (425 PSI)	C-8
HR	HEAT RELAY	A-7, C-8
LATH	LOW AMBIENT THERMOSTAT	A-7
LLS	LIQUID LINE SOLENOID	C-6
LPS	LOW PRESSURE SWITCH	C-7
PTB1	POWER TERMINAL BLOCK	D-8
RCS1	REAR CONTROL SWITCH #1	C-8
RCS2	REAR CONTROL SWITCH #2	C-8
RCV	RE-HEAT COOLANT VALVE	A-7
REC1	RECTIFIER #1	C-6
REC2	RECTIFIER #2	C-8
RHCS	REHEAT/CYCLE SWITCH	A-8
TH	ELECTRONIC THERMOSTAT	A-8
THSW1	THERMOSTAT SWITCH (A/C-HEAT)	A-8
THSW2	THERMOSTAT SWITCH (UNLOADER)	A-8
UPS2	UNLOADER PRESSURE SWITCH #2	B-7
UV1	UNLOADER VALVE #1	B-6

NOTE:		
TC	TERMINAL BLOCK C (ON CONTROL PANEL)	A-8, B-8
TB	TERMINAL BLOCK B (ON CONTROL PANEL)	

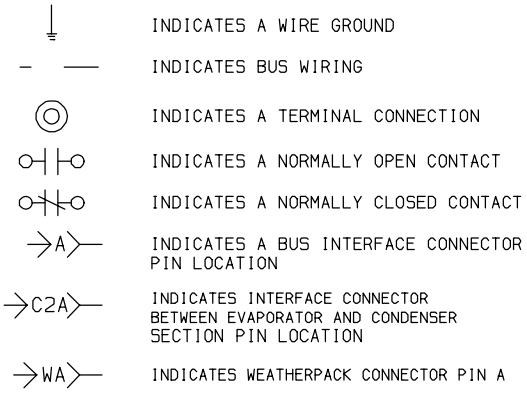

INDICATES A WIRE GROUND
INDICATES BUS WIRING
INDICATES A TERMINAL CONNECTION
INDICATES A NORMALLY OPEN CONTACT
INDICATES A NORMALLY CLOSED CONTACT
A
INDICATES A BUS INTERFACE CONNECTOR PIN LOCATION
C2A
INDICATES INTERFACE CONNECTOR BETWEEN EVAPORATOR AND CONDENSER SECTION PIN LOCATION
WA
INDICATES WEATHERPACK CONNECTOR PIN A

Figure 5-3. Electrical Wiring Schematic Diagram – Rear (68RF50 with Field Wound Motors)
Dwg. No. D-070-776 Rev B (Sheet 1 of 2)

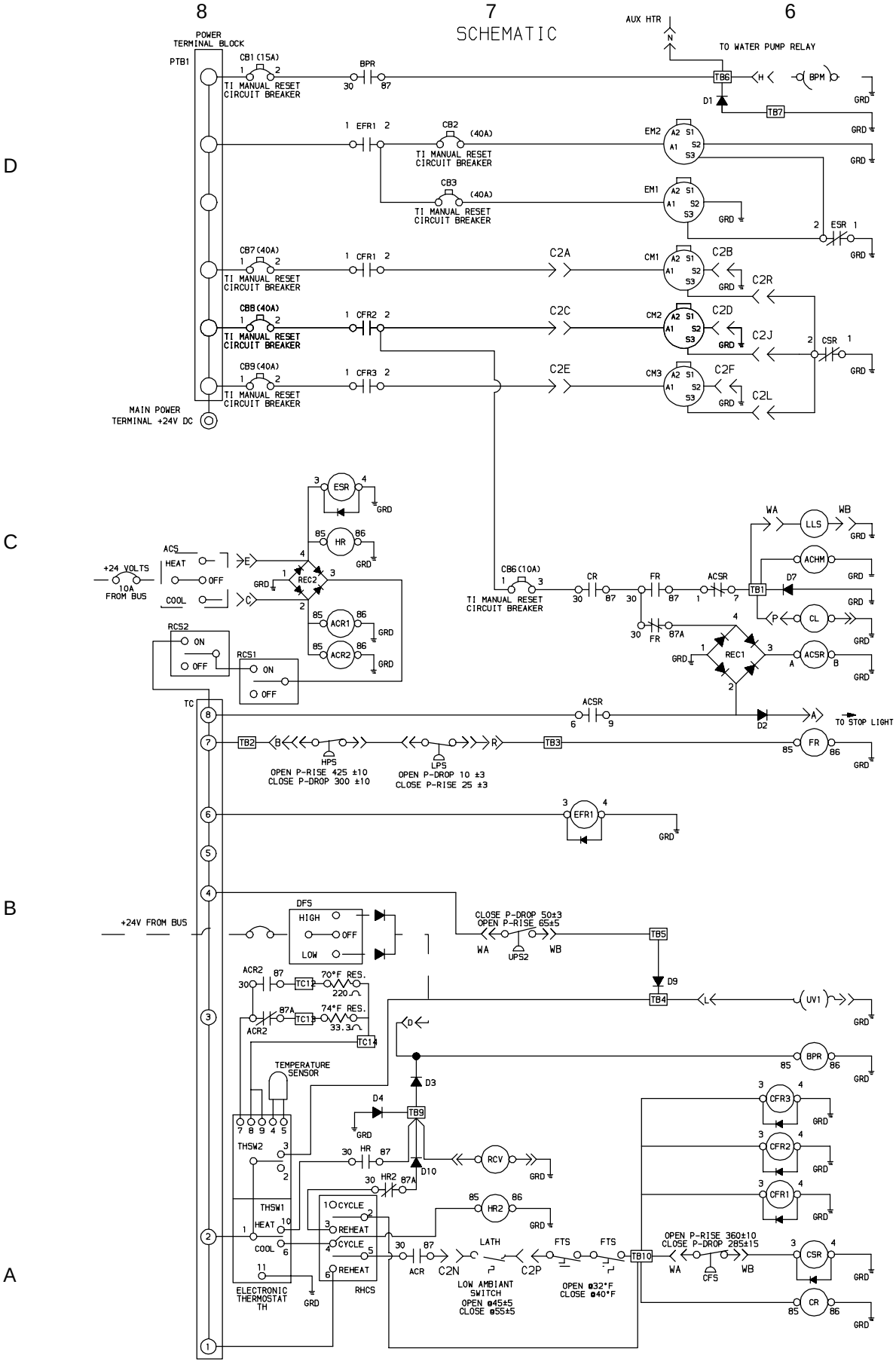
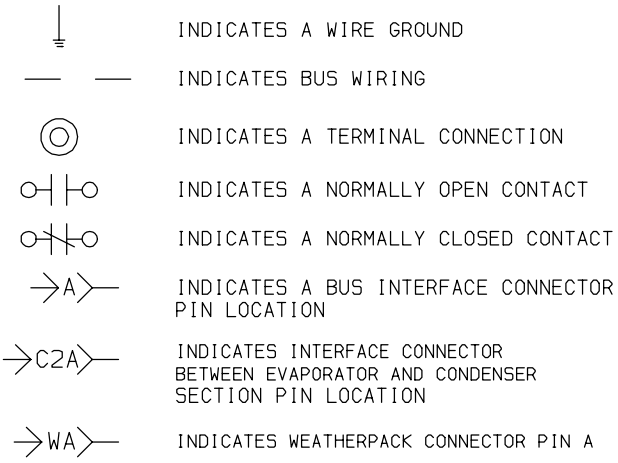


Figure 5-3. Electrical Wiring Schematic Diagram – Rear (68RF50 with Field Wound Motors) Dwg. No. D-070-776 Rev B (Sheet 2 of 2)

SYMBOL	DESCRIPTION	
ACHM	A/C HOURMETER	B-8
ACR1	A/C RELAY	A-7, C-7
ACR2	A/C RELAY #2	B-7, C-7
BPM	BOOST PUMP MOTOR	D-6
BPR	BOOST PUMP RELAY	B-6, D-7
C2A	EVAPORATOR/CONDENSER CONNECTOR PIN	
CB1	15A CIRCUIT BREAKER - MANUAL RESET	D-7
CB2	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB3	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB6	10A CIRCUIT BREAKER - MANUAL RESET	C-7
CB7	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB8	40A CIRCUIT BREAKER - MANUAL RESET	D-7
CB9	40A CIRCUIT BREAKER - MANUAL RESET	C-7
CFR1	CONDENSER FAN RELAY #1	A-6, D-7
CFR2	CONDENSER FAN RELAY #2	A-6, D-7
CFR3	CONDENSER FAN RELAY #3	A-6, C-7
CR	CONTROL RELAY	A-6, B-7
CFS	CONDENSER FAN SPEED SWITCH (360 PSI)	B-7
CM1	CONDENSER FAN MOTOR #1	D-7
CM2	CONDENSER FAN MOTOR #2	D-7
CM3	CONDENSER FAN MOTOR #3	C-7
CSR1	CONDENSER SPEED RELAY	B-7, C-7
D1-D10	DIODE	
EM1	EVAPORATOR MOTOR #1	D-7
EM2	EVAPORATOR MOTOR #2	D-7
EFR1	EVAPORATOR FAN RELAY #1	B-7, D-7
ESR1	EVAPORATOR SPEED RELAY #1	C-7, D-6
HR	HEAT RELAY	B-7, C-7
IR	IDLE RELAY	A-6
LATH	LOW AMBIENT THERMOSTAT	C-7
LLS	LIQUID LINE SOLENOID	C-7
PP	POWERPACK	A-6, B-6
PTB1	POWER TERMINAL BLOCK	C-8, D-8
RCS1	REAR CONTROL SWITCH #1	C-7
RCS2	REAR CONTROL SWITCH #2	C-7
RCV	RE-HEAT COOLANT VALVE	B-6
REC2	RECTIFIER #2	C-7
RR	RUN RELAY	A-6, C-7
TH	ELECTRONIC THERMOSTAT	A-7, B-7
UPS2	UNLOADER PRESSURE SWITCH #2	B-7
UV1	UNLOADER VALVE #1	B-6

NOTE:		
TC	TERMINAL BLOCK C (ON CONTROL PANEL)	A-8, B-8
TB	TERMINAL BLOCK B (ON CONTROL PANEL)	


INDICATES A WIRE GROUND
INDICATES BUS WIRING
INDICATES A TERMINAL CONNECTION
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INDICATES A NORMALLY CLOSED CONTACT
A
INDICATES A BUS INTERFACE CONNECTOR PIN LOCATION
C2A
INDICATES INTERFACE CONNECTOR BETWEEN EVAPORATOR AND CONDENSER SECTION PIN LOCATION
WA
INDICATES WEATHERPACK CONNECTOR PIN A

Figure 5-4. Electrical Wiring Schematic Diagram – Front (68RF50 with Field Wound Motors)
Dwg. No. D-070-775 Rev B (Sheet 1 of 2)

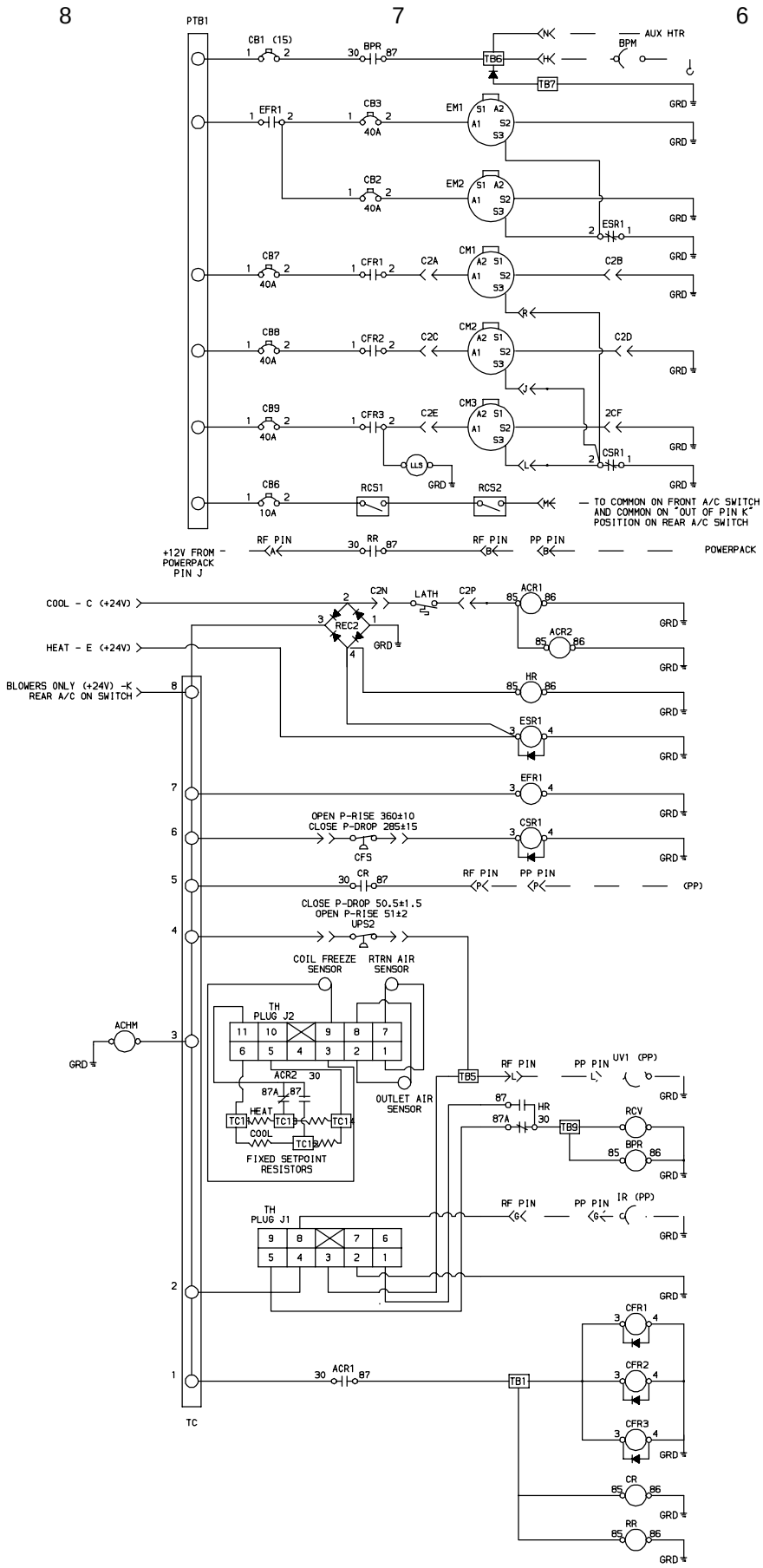

Figure 5-4. Electrical Wiring Schematic Diagram – Front (68RF50 with Field Wound Motors) Dwg. No. D-070-775 Rev B (Sheet 2 of 2)